

THE AMERICAN NATURALIST.

VOL. XXIII.

FEBRUARY, 1889.

No. 266

A CONTRIBUTION TO THE KNOWLEDGE OF THE GENUS BRANCHIPUS.

BY O. P. and W. P. HAY.

1. *The Hatching of the Eggs of B. VERNALIS Kept in Dried Mud.* *Branchipus vernalis* is, according to our present knowledge, distributed from Eastern Massachusetts to Western Indiana. It lives in ponds which are filled with water during the colder parts of the year, but which are dry during the summer months. The eggs, therefore, which when laid by the females sink down into the mud, remain during the hot months enclosed in the dry and baked earth and resume their activity and complete their development only when the cold autumn and winter rains come on.

The species of *Branchipus* whose life-history has been most thoroughly studied is *B. stagnalis* of Europe. As long ago as 1820, Benedict Prevost experimented with its eggs. Some of these were kept in dried mud for six months and at the end of that time on being put in water developed into swimming larvæ. Some of the eggs, similarly dried, were sent to M. Jurine at Geneva, and this naturalist also succeeded in obtaining the young.¹

Naturalists have hitherto not been so successful in hatching out the eggs of our species. In Dr. A. S. Packard's "Monograph of

¹ Claus, *Branchipus stagnalis*, etc. Göttingen, 1873, p. 1.



the Phyllopod Crustacea of North America,"² Dr. Paul F. Gissler gives the results of his efforts to obtain the larvæ from dried mud :

"During the whole summer of 1880 I experimented with dry mud from ponds inhabited by either the normal or pale race of this Branchiopod, but all in vain. Neither jars kept on ice in a large refrigerator, nor frozen dampened mud, gradually or suddenly thawed, developed any larvæ. The mycelium of a fungus, a few Daphniidæ and microscopic organisms were the only result."

Some time during April, 1888, the junior author collected a considerable number of females of *B. vernalis*, and selecting such as had their ovisacs filled with eggs, put them into a jar of water, in the bottom of which was placed earth taken from the garden. These females were allowed to remain here until they died, which was within about two weeks. The water was allowed to evaporate, the mud became dry and was moistened only once or twice during the summer. It was, of course, as dry as dust the greater portion of the time. On September 27, this dirt was broken up and put into another jar and covered with water. Immediately numbers of the eggs came to the surface and remained floating there about two days, when they went again to the bottom. On October 9, larvæ were, for the first time, observed swimming about in the jar and soon large numbers appeared. This experiment proves that the hatching of the larvæ of *B. vernalis* is by no means difficult to bring about, and that we may almost at will obtain them for observation. It also shows that it is not necessary that the eggs should ever be subjected to a freezing temperature.

That we have in our experiments succeeded in getting a view of the larvæ immediately after their exclusion from the eggs, we are not wholly certain. They could, at all events, have escaped but a short time before they were seen. One specimen was observed while in the act of escaping from the egg-shell ; but the specimen seemed to be unable to extricate itself and may have been sticking there for some time and meanwhile undergoing change.

One thing, however, appears to be evident, namely, that the larva differs in some important respects from that of *B. stagnalis* as figured and described by Dr. C. Claus in his paper, "*Zur Kenntniss des Baues und Entwicklung von B. stagnalis und Apus cancriformis*;"

² U. S. Geol. and Geog. Survey Wyoming and Idaho for 1878. Washington, 1883.

and it is highly probable that it leaves the egg in a more advanced stage of development.

According to Dr. Claus the nauplius of *B. stagnalis* on leaving the egg is of a dull yellow (*trubgelb*) color, which has, as its cause, a multitude of bright granules and globules, and this color is so decided that for some time the view of the internal anatomy is obscured. The larva of *B. vernalis*, on the contrary, is very pale, and will, therefore, more readily lend itself to investigations on the early condition of its internal organs.

In the case of *B. stagnalis* the post-cephalic portion of the body is at first globular, but later becomes more elongated and oval, and finally, when the limbs have begun to bud out, changes to a conical form. The same portion of the body of *B. vernalis* is from the first proportionately shorter and broader. Furthermore, there are, in the earliest stages seen by us, the lateral buds of three or four pairs of post-maxillary appendages. The most striking difference between the larvæ of the two species appears, however, to be found in time of appearance of the paired eyes. According to Claus those of *B. stagnalis* do not appear until the first and second pairs of thoracic segments have become four-lobed and ten or eleven segments have been marked out. The larva of *B. vernalis* appears to possess both the median and the paired eyes at the time of escape from the egg; at least the paired eyes are plainly visible in the earliest observed stages, when there are but the merest swellings to indicate the positions of the first four thoracic limbs. Thus the true nauplius condition of *B. vernalis* appears to be passed through before the larva escapes from the egg; it is excluded as a metanauplius.

It is interesting to note that the larva which we saw endeavoring to escape from the ruptured egg-shell was enveloped in a thin transparent membrane. Whether this was the inner egg-membrane or a blastodermic moult we do not undertake to say. Zaddach's observations on *Apus* will be recalled in this connection. (*De Apodis cancriformis*, 1841).

Our smallest larvæ measured in length $\frac{2}{3}$ inches.

II. *Description of a supposed new species of Branchipus*, *B. GELIDUS*. Male conforming closely to the description of *B. bundyi*, Forbes³, except that the caudal stylets are linear-lanceolate instead of broad and blunt. Frontal appendages long and narrow. Clas-

³ Illinois Museum Nat. Hist., Bulletin No. 1. p. 25.

pers grooved on inner side near the tip, and terminally tridentate rather than bifid, there being a third process which is situated on the anterior edge of the tip of the clasper; this process rounded instead of pointed. Female characterized by a structure that could hardly have been overlooked had it been present in *B. bundyi*. This consists of two prominent processes of a conical form that grow out from the dorso-lateral surface of the tenth thoracic segment, one on each side, and project backward, across the eleventh segment and for a short distance on the segment that contains the genital organs. The posterior ends of these processes stand out free from the body. The ninth segment with a similar but much smaller process on each side, which overlaps the one on the tenth segment. Ovisac about as broad as long and with a prominent median process.

The function of these dorsal outgrowths is not known to us. It may be suggested that they furnish means for the male to retain firm hold of the female. The claspers of this species are far less powerful than are those of *B. vernalis* and may not be alone equal to the task imposed on them. Possibly the rounded tubercle found at the base of the second joint of the claspers is applied to the processes on the back of the female and held retained by means of the minute suckers on the tubercles.

In order to ascertain the nature of the outgrowths found on the females, consecutive series of sections were cut from hardened and stained specimens. The organ in question is, of course, bounded outwardly by a chitinous wall; but it is also, at most points, distinctly separated from the rest of the body by another wall of chitin. This is, however, incomplete, so that the cavity of the process is in communication with the cavity of the body. From the interior wall there radiate outward to the external wall a great number of bands or trabeculae also apparently of chitin. These bands, as they pass outward, divide and anastomose so that the interior of the process is divided into communicating cells. Where the process frees itself from the body these bands soon cease to be seen. For some little distance behind the points where the processes leave the body there is found, along the middle of the back, the double-wall arrangement, with chitinous bands running from the inner wall to the outer. In the meshwork of chitinous bands, especially of the processes, there are found numerous small nucleated cells or corpuscles. The extremities of the processes are filled with these.

As to the habits of this species little is known. In the pond where large numbers occurred in the spring, no specimens of *B. vernalis* were seen. This fall when the same pond was visited not a specimen of the new species was to be found, while *B. vernalis* abounded.

It was observed that while the males were swimming about, the long and narrow frontal appendages were frequently rolled up and again extended. They present under the microscope a beautiful network of muscular fibres, in the meshes of which are numerous ganglionic cells.

A CORNER OF BRITTANY.

By J. WALTER FEWKES.

"BILLET pour Roscoff, s'il vous plait." The train is waiting at the Gare St. Lazare in Paris, and in a few moments we are hurried along beyond the fortifications, past Bellevue, Sevres and Versailles, through a wooded country, alternating with rich farms and beautiful fields. All day long we ride through Normandy and Brittany, looking out of the window of the coupé on one of the most interesting landscapes of France, crowded with towns and cities of historic interest and scenic beauty, every hour presenting some new phase of life to relieve the monotony of the trip. What is our destination and what leads us to turn from the beaten tracks of European travellers? We have abundant time to answer these questions before we reach the end of our journey.

Our destination is Roscoff, a town in the department of Finistère, frequented by artists, better known to naturalists, and too rarely visited by travellers, who have penetrated into all the most picturesque corners of Europe. Roscoff, a fishing village, truly Breton in character, preserving many features of the old France, and presenting a pure example of ancient Brittany, unchanged by modern innovations. Roscoff has not a casino nor knows the swarms of pleasure seekers which many other towns on the coast of France draw to themselves every summer. It has no delightful promenades, no beautiful forests, but it has its wonderful rocks, its soft, laughing cli-

mate, its southern flora, its fertile lands, its hardy fishermen with their original costumes, its picturesque homes, and its beautiful church. Of more importance than all to the naturalist, it attracts him as the site of one of the most interesting of all those institutions for the study on the sea-shore of marine animals, the *Laboratoire Experimentale et Générale*, founded by Prof. Lacaze-Duthiers. It is this establishment which turned me to this distant corner of Finisterre, where I was permitted to spend two of the most charming months of a summer's vacation in Europe.

Roscoff is situated on the confines of Brittany, on a peninsula which juts out into the English channel, about opposite Plymouth in England. Away from beaten lines of travel it is unaffected by the changes which are being made in the larger cities about it, and remains, as it was when Mary Stuart landed on its shore, a veritable survival of the old Brittany of three centuries ago. Artists know it, and naturalists have long studied the rich life which peoples its coast and the waters which bathe its shores. Lovers of nature find there a sea most savage, and cliffs most rugged and picturesque. The blue sky of the Mediterranean and the beautiful water ever changing and never tranquil are here. Its islands are eroded by the ocean into fantastic shapes so that their contours rival our own "Garden of the Gods" in their grotesque shapes. The whole appearance of the coast, changed in a few hours by the great tides, the wonderful scenery on all sides, these are some of the beauties of nature which once seen retain the visitor in this interesting place day after day and week after week.

The place is situated on a small peninsula, the main street extending along the sea, and terminating at either end on the coast. Near one end of this street there rises a bald cliff capped by an ancient chapel of Sainte Barbe and a small fortress called the *Bloson*. At the other end this road broadens and opens into a place called the *Vil* upon the sides of which arise the *Hotel du Bains Mer*, the church, and the Marine Laboratory. On either side the main street of the town is lined with picturesque old houses, many of which date three centuries back, bearing the stamp of an old civilization. Small side passages lead to the shore on one side of the street, while on the other are narrow passage ways leading into tortuous alleys which extend out into the cultivated fields. Midway in the course of the main street, between the chapel of Sainte Barbe and the *Vil* or place of the church, is the port, an artificial structure, forming a

high breakwater in the hospitable protection of which lie a few small craft. At high tide these vessels swing at anchor, but the retreating sea leaves them stranded high and dry on the shore.

The old houses which line the main street of Roscoff date back to the sixteenth and seventeenth centuries and are all built in the peculiar style of those times. The doors are low with oftentimes a small lookout or window at one side of the entrance. The object of these windows carries one back to the times of the corsaires, when the prudent inhabitant was obliged to have some means of observation before he opened the door and allowed a visitor to enter his home. The windows are placed high upon the roofs and are ornamented with rudely-cut, grimy faces and grotesque heads of dragons. The long sloping roofs, sparsely covered with plaster, give the appearance of a recent snow storm. The houses are built of granite much eroded and with their walls often whitened by lime. With the exception of the apothecary and one or two other modern buildings none of the shops have visible signs to denote the wares which are on sale. Glass is rare in the windows and the cellars open obliquely to the pavement of the street. On the seaward side the houses are separated from the ocean by courts and gardens protected from the ravages of the ocean by high walls, which form the fortifications of the place. At intervals on the walls there are lookout towers in which, no doubt, many a time the old Breton corsaires have watched a strange vessel on the channel, or from which the wreckers perhaps have enticed a passing ship to its doom.

These houses are now the homes of the sailor and the fisherman, but in times past the smuggler found there a secure refuge from his enemies. These mysterious, small, narrow streets, leading down to the water's edge, all remind us of the trade of the smuggler and the wrecker. These men have long since disappeared from Roscoff, but the old houses, the narrow tortuous passage ways still remain and recall the history of the romantic times of the past.

On the western side of the peninsula on which Roscoff stands there is a sandy beach out of which rises in the form of a marine monster a precipice called Roch-Croum. Seaward from this cliff a number of islands much eroded project in fantastic shapes, a scarred battlement broken in points by the resistless ocean. In the forms of these rocks we can trace many a giant's head, or fancy many a monster rising out of the waves, which continually beat at their bases.

The eastern side of the peninsula is still more picturesque than the western. It forms a part of the magnificent bay of Morlaix and its cliffs rise abruptly out of the sea. Here the fortress of Taureau, a wonder of Brittany, projects out of the ocean from a submarine reef.

There is but one road leading to Roscoff from the mainland, and that bisects the peninsula entering the main street near the church. It is the national road to the neighboring city called Saint Pol. On either side there branch off true Breton lanes lined by lofty embankments thrown up by the farmers. No trees, nothing but sandy fields of onions and potatoes line its borders. Everywhere the, land swept by the high winds of the Atlantic, has a somber, melancholy look. The hills are low, and here and there rocks project through the thin covering of sand, but otherwise the landscape is little varied.

The sea, however, at Roscoff makes up the interest where the land fails to attract. Nowhere have I seen such a variety in the sky and horizon, nowhere a more savage coast resisting a more determined ocean.

There are many neighboring islands, the largest of which is called the Ile de Batz, a strange name, taken from a tongue reaching back before the origin of the modern French tongue. Near by this Island there are the so-called Bourguinous, and still further away Tisosou, "the house of the English." Some miles more distant seaward the rock of Pighet, all of which islands are remnants of a former battlement which, resisting the inroads of the sea, are fast losing their form and size in protecting the mainland. Sown here and there are submerged rocks most fatal to navigation around which course "cail-loux" or currents which render the approaches to the port so dreaded by sailors. As one glances across the channel from the island, Roscoff seems a very large city. Its sea-wall, its row of houses along the shore and the elegant church would lead one to exaggerate the size, but the town is simply a crescent of houses, enclosing fertile fields of potatoes and onions.

Such is a brief sketch of the place to which we are hastening through Brittany by way of the railroad from Paris to Brest. We alighted at Morlaix, a picturesque old town, which has contributed many a sketch to the artist's portfolio, early in the evening, and take a branch road to Roscoff. Somewhat later the train halts and we have reached our destination.

"A La Maison Blanche," says a man near me, in an accent which is immediately distinguished from that of the Parisian "cocher." "Oui!" is replied in a confident tone as if a knowledge of the whole French language was at the tongue's end. He asks if I am the American who is going to work in the laboratory and I reply that I am. We trudge down the dark road unlighted by a single lamp, and in a few moments the hostess of "La Maison Blanche" had me in charge. The hotel looks comfortable but its surroundings are very strange. The threshold of the entrance is lower than the pavement of the street. Along the entry hang rows of chickens, legs of lambs, sausages and vegetables. A crowd of Roscovites hang about the bar, which is elaborately filled with all the necessities.

The hostess has picked up a little English from the numerous sailors who frequent her house and gives me a good reception. A bed of purest white and an excellent cup of coffee and bread in the morning form a cordial introduction to a town in which I was destined to pass many, very many, happy days.

French naturalists were the first to found special institutions on the seashore for the study of marine zoology. There are many problems connected with the study of marine life which cannot be successfully taken up without a residence near the localities where the animals live, for they must be worked out either on living or fresh material, and it must be possible to have ready access to the habitats of these animals to study these questions. A first step in this work is to watch the animals in aquaria and carefully study their mode of life. With the improvement in methods of research a work room near the aquaria thus becomes a necessity for a successful answer to many problems.

One of the earliest laboratories founded especially for the study of marine life on the shore was created by Prof. Lacaze-Duthiers at Roscoff. This institution is an "Annexe" of the Sorbonne in which the founder holds a professorship of Natural History, and over the door is placed this significant inscription, so often found on public buildings in Paris, "Liberté, Egalité, Fraternité." This motto has here a new significance, and I thought as I approached the building of the well-known laboratory in Roscoff on the morning after my arrival, how much that motto means in the organization of the institution. The advantages are free to all of every nation, French, English, American, Russian. Every specialist is freely given without expense the advantages of the institution. All are equal who enter its walls

with a love of nature and a desire to study, or to investigate. No one who has known its hospitality can question the justice of the third word of the legend.

The laboratory founded by Prof. Lacaze-Duthiers is a laboratory for students as well as investigators, and it numbers among its workers those who have earned the title of naturalists as well as those who have just begun their studies. It is not too much to say that every facility which experience and money can suggest are here placed without expense within reach of every student of zoology who makes a choice of Roscoff for a working place.

Everything is free, microscopes, reagents, boats manned by experienced collectors, books, work-table, instruction, all are given with a lavish hand, with no distinction of nationality or peculiarity of scientific belief. There is no charge for an opportunity to contribute to the advance of knowledge or to take the first steps in the acquisition of methods of research.

The students in the laboratory are even furnished with sleeping rooms near their working tables, so that no time may be lost or expense incurred. In liberality there is no known institution outside of France which does more or even as much for those who wish to investigate marine animals.

The laboratory at Roscoff is a laboratory for summer work and is supplemented by a second creation of the same founder at Banyuls-Sur-Mer on the Mediterranean Sea, for research in winter. These two, both connected with the University of France, offer a continuous opportunity at all times of the year for the study of marine animals of the two shores of France. They open to students two different faunas under the most experienced instructors, the most favorable influences under the most liberal circumstances.

The laboratory at Roscoff not only furnishes material for investigation, but it also presents opportunities for collecting, and for the study of marine animals in their native habitats.

In the study of marine animals on the shore, as well as in museums and laboratories situated inland, students may become closet naturalists. It is recognized that it is a good thing to collect as well as to study animals after they are collected. Two methods of work on marine animals are possible. Either the naturalist may remain at his work-table and have experienced collectors bring him what he desires to study, or he may himself visit the localities where the animals live and find them himself. Both methods have advantages,

but the latter gives a wider knowledge of the whole subject than the former, for it familiarizes one with natural conditions of the life of the animals.

The laboratory at Roscoff not only permits a study at the workable but also offers facilities for collecting. Excursions are made to grounds where certain animals occur and in that way the possibilities of knowing more of their mode of life are increased. This feature in the marine laboratories of Prof. Lacaze-Duthiers is certainly a most important one and one which particularly commends itself to a person whose sole knowledge of animals is based on specimens preserved in a museum or brought to him by a professional collector. We may study the histology, or anatomy of an animal without knowing whether it lives in the sand or is free swimming, whether it is dredged or inhabits the shore line, but it is better to combine with that knowledge some familiarity with its natural habitat and its mode of life. One excellent feature in the Roscoff laboratory and one which attracted me to it is the fact that it offers facilities for both kinds of work.

There are two different departments in the laboratory at Roscoff, one for students who are beginners, the other for those who are investigators engaged in original research. These two departments work harmoniously and the advantages are equal for both.

The apparatus of a laboratory and the manner of investigation belongs to the technique of zoological work, a consideration of which would take me too far into details for this article. There are many excellent features in which this laboratory differs somewhat from those of other institutions of this kind, but in all marine laboratories with the readiness with which new methods are made public there is a surprising uniformity in technique in all marine stations. I should say that at Roscoff there is a proper regard to the relative importance of all branches of marine research, toxonomy, histology, anatomy and embryology, although perhaps the published results in the latter branch may show that it is not at present given the predominance that it has in some other similar institutions.

An excellent feature in the laboratory at Roscoff is the existence of a small local collection identified for the use of investigators and students. For the information of those engaged in the study of animals found there a card catalogue with a notice of the time of collecting the genus, locality where it is found, the time of laying

its eggs is an excellent help. Anyone describing a new species or genus is expected to deposit in the collection a single specimen to serve as a type for the good of those who may later avail themselves of the advantages of the place.

In our own marine zoological stations the existence of a catalogue stating the time when ova, embryos, or adults could be found or had been collected and where they occur in abundance, would be an excellent thing, and must in the course of time be made by competent observers.

The beach of Roscoff is one of the richest grounds for collecting marine animals which I have ever visited. The enormous tides lay bare an extent of bottom which is extensive, and betrays the home of a very large number of different genera of animals which live along the shore. Moreover the character of this life is greatly influenced by a branch of the Gulf Stream, which making its way from the main current bathes this part of Brittany and imparts to it the mild climate which it has. This same current also tempers the climate of the Scilly Islands, which lie in its direct track, so that several plants, which are limited to the shores of the Mediterranean, here flourish in a more northern latitude.

The rich fauna of the coast at Roscoff is, no doubt, more or less modified by the warm action of this branch of the Gulf Stream, still the floating life which distinguishes this great ocean current off the coast of the United States is almost wholly wanting. Now and then some straggling "Portuguese man-of-war" drifts into the channel, or some medusa, whose home is in the tropics, is captured, but these are exceptional. The wealth of floating marine life which the Gulf Stream brings even to the coast of New England is not found inshore on the coast of Brittany.

The most interesting building at Roscoff is the church, the steeple of which is to be seen from almost all sides of the city. This church, which has an appearance wholly Breton, has also a style partly Florentine, partly Spanish; for the interior, at least of many of the Breton churches, has a true Italian appearance, and the style of the exterior is characteristic.

The most curious part of the church is the steeple, which, as we approach the city from the sea, rises light and airy and seems almost to hang from the sky. On the side of its bell-tower, pointed toward England, the hereditary enemy of the Roscovite, there are two cannon, cut in stone, forming parts of the varied ornamentation of the steeple.

At the base of the tower on either side of the entrance one sees at right and left bas-reliefs ascribed to the fourteenth century, representing the Passion and Resurrection of the Savior, while above the entrance is one of the most interesting bas-reliefs of all the sculptures of Roscoff, a ship of the fifteenth or sixteenth century, carved in stone with scrupulous exactness. This ship is found on the walls of the church and on the hospital situated on the way to Saint Pol and seems to be the coat-of-arms of the city. Its bizarre shape, recalling the old ship of the corsaires is of very great archæological or, at all events, historical interest.

The church itself is surrounded by a low wall enclosing many trees. On either side of the main entrance there are two small buildings one ornamented with a bas-relief of the ancient ship; the other a small mortuary chapel. These are ossuaries which in old times served for receptacles of the dead. When the church-yard was full, these buildings received the overflow. Their little niches are now empty, but they still remain mute remnants of the manners and customs of a time not long past.

In the neighboring city of Saint Pol, however, we find the ossuaries in the cemetery still occupied by the little boxes in each of which is a human cranium, and around the altar of the church in the same place, we find similar relics of the dead. In the cemetery of Saint Pol these ossuaries are small buildings with covered shelves along which is seen a row of boxes each resembling a dove cot with a roof-shaped top. Each box has a small opening, diamond or heart-shaped, through which the skull of some old inhabitant can be seen, and each box bears the name of the dead. Around the altar of the church these boxes are arranged in a melancholy row. "It is considered an honor," said the father who showed me about, "to have the head thus preserved near the altar, an honor which only a few and those the most influential are permitted to share.

This survival of a habit of burial once widely spread in Brittany and France is archæologically very interesting, but at the present day the custom is wholly given up.

The church of Notre-Dame de Croatz-Batz with its interesting ossuaries may be called an historic monument of France and is an instructive relic of times long past, but there is another church, now in ruins at Roscoff, which also merits our attention. This is one of the few places of this distant town connected with the general history of France. Nothing now remains of this chapel but the

bare walls, a veritable ruin looking out on the main street of the place. Mary Queen of Scots landed at Roscoff on the 14th of August, 1548, on her way to espouse the Dauphin of France. Years after a chapel was dedicated to a Scottish Saint, Saint Ninien, in commemoration of this event.

Mary Stuart was but six years old when she landed at Roscoff. She remained there but a short time and then proceeded to Morlaix where she was officially received by Seigneur de Rohan. Afterwards she went to Saint Germain en Laye, where she is said to have remained until she was eighteen. Long after, when the widow of Francois II., she returned to Scotland and to the sad history which awaited her in England, the hereditary foe of the Bretons, on whose land she had set her foot in happier days long before.

The chapel which marks the event of her landing was for many years ornamented with many presents and remained a magnificent monument of her generosity. Later it fell in ruins and now after many years the Roscovites have placed on its wall a tablet that tells to the curious the event which the building of the chapel commemorates.

Not far from the chapel of Mary Stuart, there stands a house rebuilt in modern style, the interior of which is always interesting to visit. This house is separated from the chapel by a narrow street, and in it one still sees the remnant of an ancient cloister, with a beautiful garden protected from the sea by a tall wall in the form of the prow of a vessel. Once a cloister, then a place of meeting of merchants, it now remains an interesting relic of the Roscoff of the past, its solid columns and architecture recalling some old Italian palace of mediæval antiquity.

Many other interesting houses exist in the quaint old town of Roscoff. The many hiding places for bandits and smugglers, the dark cellars, narrow streets, all recall the old days when much of the enterprise of the place was turned to the plunder of passing merchantmen, or equally nefarious practices. The history of the Roscovite corsaires has yet to be written, but the story of Le Negrier still preserves something of the romance of the past. Here we read of the old hotel Terard, where the notorious Captain Le Bihan recounts his escapades. We also read of a ball of the corsaires in which all the inhabitants of the place participated.

The little port of Roscoff was the rendezvous of the corsaires who fled to its hospitable walls protected by the Ile de Batz. There

secure from English cruisers, they remained until another opportunity gave them a chance to sally forth on their marauding expeditions.

There are many other interesting old houses in Roscoff. As we follow the road to St. Pol, we pass the famous Hospital built in 1598, on the walls of which stand out the escurian of the Comte de Leon, boldly cut above the gate. More distant still the monastery of the Capuchins, in the garden of which may still be seen, the giant fig-tree, a marvel of Roscoff, and a proof of the wonderful fertility of the soil. This gigantic tree was planted long ago by Capuchin monks and still remains contributing its fruit—a tree more than two centuries old.

One should not neglect, in visiting Roscoff, to see the place called Kersaliou. Midway in the route from Roscoff to St. Pol, hidden in the trees, and approached by a by-path, is the retired house known in the country round as the Kersaliou, an interesting place where one can at the present time study the true Breton home. Our visit to Kersaliou gave us a good sight of the mode of life of the Breton farmer and his family.

The old house, Kersaliou, was evidently formerly the residence of men of more property than at present. It stands back from the road hidden in the trees, and as one approaches it from the main road to St. Pol, it has a most picturesque outlook. We pass through the gateway, an elaborate stone edifice, into a small court yard in which the poultry of the farm find their home, through the low door into the living room of the families which at present occupy the place. The room on the lower floor is certainly a study. At one end of the apartment there is a large fireplace on which the fire continually burns or smothers in the coals. On either side are seats where children sit in the recesses of the high chimney. No matches are used to light the fire, but a small pan of sulphur hangs near by and a bundle of sticks. When there is need of more fire these sticks are used, their tips dipped in the sulphur and ignited by the live coals. There is a cemented floor to the apartment, which is kitchen, dining room and sleeping room combined. On one side we notice a large cabinet, like a huge bureau with elaborately carved wooden front—it is an enormous wall cabinet with what appears to be many drawers, which are the beds, and as the house-wife pulls them out one by one, in the depths we see the whitest bed clothing. These

drawers are beds in which sleep the three generations of two families which live in this house.

A small box covered with a lid in which holes are pierced, is the cradle from which ominous cries have already issued indicative of the contents. It was time for the afternoon meal when we visited Kersaliou, and we were invited to share their repast with the hospitable family. The house-wife had already placed fourteen rough, earthen bowls on the table, and was breaking in each fragments of bread. The soup was boiling over the fire, and in a few minutes the dinner was ready. Each bowl received its share of liquid poured over the bread, and the family began their simple meal. Above the table hung a frame on which were placed wooden spoons and each one took his spoon from the common source. There was no need of knives or forks. The kind-hearted inhabitants of Kersaliou were true Bretons, conservative, religious, hospitable and industrious. Two grandmothers, two mothers, their husbands and a host of children, of whom only one little girl spoke French. All converse in the antique language of Gaul, a Celtic tongue allied to the Gaelic of Wales. We do not have to travel far from Roscoff to lose the soft, melodious French and then hear on all sides the old Breton, which is not a patois, but the original celtic language that dates into the remote past, and which no effort can eradicate from the country.

The old language is the common language of the country. French is an innovation which makes its way slowly but surely. The preaching in the cathedrals and churches is in Breton; the common people use no other language, and all localities bear names which will probably recall this tongue even when unspoken by the descendants of those who now inhabit the land.

Brittany is full of those curious stone structures antedating historic times, and called cromlechs and dolmens. Everywhere we find these druid monuments, at one time formed by circles of stones simply stuck up in the ground, by lines of huge rocks as at Carnac, or simple slabs placed on uprights. Roscoff has one of these monuments in its immediate vicinity. On the road to St. Pol near the latter place, we turn off from the main road into a field of cabbage, and not far off we find the dolmens of Roscoff, high upright rocks, upon which is placed a horizontal slab. Unfortunately one of these horizontal slabs has fallen, for a hunter for buried treasure has dug under the foundation and undermined it, but one can still study the

general character of the monument. This monument, as all the others of similar kind, is associated with the worship of the Druids, and dates back to ancient times. More of its use we do not know, but we were well repaid for our short visit. We turn back towards Roscoff from this antique structure along the road. In the distance we see the beautiful cathedral of St. Pol, but we must reserve our visit to this city to another time. The far distant sea, the Ile de Batz and the beautiful town of Roscoff stretching along the shore lies just before us, lit up by the rays of a setting sun.

The Roscovite is a Celt with traces of the Spaniard. He is industrious and frugal, always conservative and religious. He still retains the costumes of his fathers, his *gilet* with conspicuous buttons, his waist girt by a highly-colored band, his round hat with ribbons falling on his shoulders. He wears the sabots, he clings to the old language of Gaul.

The women are not beautiful, but they have fine eyes and well-preserved teeth. They also still retain the old costumes. The small white bonnet, worn at all times, is so tightly bound about the head that nothing can be seen of the hair. On the days of baptism or marriage, however, when the bonnet is taken off, a charming coiffure is seen and the beautiful hair bursts forth in all its charms from its hermetically-sealed prison. Each town in Brittany has a peculiar bonnet and that of the young maidens differs from the matrons.

If you wish to see religious faith go to Breton, to Roscoff. Modern science, modern free thought, has not yet a hold in this place. The Breton is religious by nature. Every one goes to the church and the whole population turns out *en masse* to the morning service. According to Reclus, Brittany is still pagan, but while the inhabitants do not worship the forces of nature, the rocks, the fountains, or the trees, they repeat the same prayers to God in the Christian church, which they have made for two thousand years, only addressed to a new divinity. "It is always the same religion continued from century to century without the inhabitants of the land perceiving the change in their divinities." The geographer, however, has drawn an exaggerated picture. The country has emerged from its old beliefs, but while much of the middle-age thought still clings to the religion, it moves less rapidly, more conservatively than in many other lands.

No one who visits Roscoff should fail to see the giant fig-tree. The soil of France nourishes no greater marvel of plant-life than

this wonderfully vigorous growth of the ages. This tree, situated not far from the main road in an enclosure in which it is sheltered by a high wall, yearly bears its fruit in a latitude which in America is half the year buried in the snows of Labrador. The mild climate which Roscoff owes to the Gulf Stream, gives to this land an exceptional flora, and the intelligent cultivation of the soil has transformed the country into a great garden for the raising of all kinds of vegetables. The potatoes, onions, beans, cauliflowers of Finisterre are well known in England, and many an English vessel is engaged in the transportation of them across the channel. The inhabitants cultivate one of the most storm-swept coasts of France, but the yearly products of their industries is inferior to no other in quality or in quantity.

Roscoff is also a shipping port for the lobster and the *Palinurus*, many of which are found in the restaurants of distant Paris. A huge vivier where these animals are kept before shipment has been built near the entrance to the harbor. This vivier is supplied from the waters around the place and even from the distant coast of Spain. Thousands of these animals are yearly sent to the great cities of France and England from this little town.

The shrimps of Finisterre are well known far and wide and the "crevette" fisherwomen with their huge nets are often found in the pictures which artists have brought home to their Parisian studios, after their vacations in Brittany. When the tide is out these toilers of the sea take advantage of the small pools in which the shrimps are retained and fill their nets with this much-desired crustacean. The table of the hotels in Roscoff know also the periwinkles, a small gastropod which is universally eaten. The sea furnishes many a food fish which has not yet been adopted in other lands.

As the days go by all too fast and the time of our tarry in Roscoff is more and more reduced, we came to love its quaint old streets and church, its old houses and its antique walls more and more, but the summons back to Paris is imperative and we find ourselves back again at the station of the railroad to Morlaix. We bid adieu to the Maison Blanche, the Café de la Marine and the hospitable walls of the Laboratoire. We say good-bye to the naturalists who still linger there to finish their researches, with many a regret. In a few moments all are left behind, but we retain what can never be effaced from memory, a souvenir of the happiest two months of scientific study which we have ever past. May the splendid ma-

rine station at Roscoff and its enthusiastic master long continue the work which has had so much influence on French science, and may its liberality and hospitality be imitated and fostered in other lands by other people.

ON THE PERMIAN FORMATION OF TEXAS.

BY CHARLES A. WHITE.

¹ Published by permission of the Director of the U. S. Geological Survey.

DURING the past ten years Prof. E. D. Cope has from time to time published descriptions and figures of vertebrate remains from Texas which he referred to the Permian,² although other authors have generally regarded the formation from which the fossils were obtained as of Triassic age.

A year ago Mr. W. F. Cummins, Assistant State Geologist of Texas, who had collected a large part of the vertebrate fossils just referred to, gave me a small suite of invertebrate fossils which he had collected from the same formation with the vertebrates. I found these fossils to possess so much interest that I afterward, in company with Mr. Cummins, visited the region in question and made collections from, and observations upon, the formation containing them.

Thirty-two species of invertebrates were collected, about one-half of which were readily recognized as well-known Coal-measure species, but a few of them were new, among which are two belonging to mesozoic types. It is this paleontological feature, in connection with important correlated facts, that especially excited my interest in the formation from which the fossils were obtained.

Although I have personally examined a considerable portion of the region within which this formation occurs, I am indebted to

¹ This article is an abstract from a bulletin of the Survey now in course of preparation.

² For his summary of North American Permian vertebrates, including this Texan fauna, together with references to the places of publication, see *Trans. Am. Philos. Soc.* Vol. XVI, pp. 285-288.

Mr. Cummins for a large part of the facts upon which the following description of it is based. This is especially true with regard to the extent of the area which it occupies.

In Texas this formation occupies an area, many hundred square miles in extent, which constitutes the western part of the southern extremity of the great central paleozoic region of the continent. The southern boundary of this area is not now definitely known, but it lies at least as far south as the Concho river. Its eastern boundary may be approximately designated as extending from Red river to the Colorado through Clay, Young, Shackelford, Callahan and Runnels counties; and its western border as extending from the Canadian river to the Concho through Hemphill, Wheeler, Donley, Briscoe, Motley, Dickens, Garza, Borden and Howard counties. The formation is known to extend northward far within the Indian Territory, but in this article special reference is made only to that portion of it which is found in Texas; and the description which is herein given is drawn mainly from observations made in Baylor, Archer and other contiguous counties.

This formation rests directly and conformably upon another series of strata in which a characteristic Coal-measure fauna prevails but which is not now known to include any fossils of mesozoic types, if we except the *Ammonites parkeri* of Heilprin, which he states was obtained from Carboniferous strata in Wise county.³ Notwithstanding the mesozoic character of a part of the molluscan fauna of the upper formation, the preponderance of evidence makes it necessary to regard it as belonging to the great Carboniferous system, and as constituting an upper member of it. For these and other reasons yet to be stated I have little or no hesitancy in designating this Texan formation as Permian, as Prof. Cope has done; but I shall briefly discuss in following paragraphs the propriety of the use of that name for all of the North American strata to which it has been applied.

The Texas Permian is distinguishable in general aspect and in lithological character from the formation which underlies it and which represents at least a large part of the Coal-measure series as the latter is known in the Upper Mississippi Valley. And yet the Permian strata blend so gradually with those of the Coal-measures beneath, and with the gypsum-bearing beds, above that it is difficult to designate a plane of demarkation in either case.

³ Proc. Acad. Nat. Sci. Philad., Vol. XXXVI, pp. 53-55.

The strata of the Texas Permian consist of materials which are somewhat difficult to describe, but they may be stated in a general way to consist mainly of sandstones and sandy and clayey shales, which are sometimes calcareous, with a few layers of impure limestone, besides one somewhat important limestone horizon. A common characteristic of many of the layers is the presence of an abundance of small, hard, rough concretions, which usually become separated and accumulate upon weathered surfaces as the imbedding clayey material is removed by erosion. But what strongly impresses the general observer is the prevailing reddish color of the formation, which is due to the prevalence of red oxide of iron in most of its component materials. During the rainy season the waters of the streams which traverse the formation are reddened by the abundant ferruginous, clayey sediment, which they obtain by erosion.

The stratification is generally more or less regular, but in the district here especially referred to it contains comparatively few compact, evenly-bedded strata. Therefore the formation having been, in this district, only slightly disturbed since its deposition, few striking features in the landscape occur. That is, the district is a comparatively plain country, the surface of which, in the general absence of forests, is diversified only by shallow valleys of erosion and low hills of circumdenudation, with here and there a hill or bluff of like origin which reaches a height of one or two hundred feet above the general level. From the top of these higher elevations extended views are to be obtained, which are of much advantage in the study of geological structure in that region.

Because of the slight disturbance which the Permian strata have suffered in the district referred to, and the general absence of bold escarpments, it is difficult to arrive at an accurate measurement of its thickness, but it is approximately estimated at 1,000 feet. By distant view from the hills before mentioned, a general, gentle dip to the westward of the whole formation is plainly discernable. It is from a succession of such observations of the dip, together with measurements of the thickness of exposed strata and estimates of that of the unexposed, that the foregoing estimate of the full thickness of the formation has been made.

A list of all the species of invertebrate fossils that have been discovered in the Permian of Texas is given on a following page. Prof. Cope's list of vertebrate species, already referred to, shows

that the same formation has furnished 10 species of fishes, 11 of batrachians and 33 of reptiles; 54 species in all.

The full thickness of the Coal-measure series in Texas is not yet known, its base not having been observed; but the portion that has been examined reaches an estimated thickness of 1800 feet. The strata are generally somewhat evenly bedded, and consist of bluish and gray limestones, gray and ferruginous sandstones, bluish and carbonaceous shales and clays; and several coal horizons are now known in the series there.⁴ These strata have furnished at numerous localities, and in greater or less abundance, such characteristic Coal-measure invertebrates as the following: *Terebratula bovidens* Morton, *Spirifer cameratus* Morton, *Athyris subtilita* Hall, *Productus cora* d'Orb., *P. nebrascensis* Owen, *P. costatus* Sowerby, *P. semireticulatus* Martin, *Hemipronites crassus* Meek and Hayden, *Myalina subquadrata* Shumard, *Allorisma subcuneata* M. and H., *Nuculana bellistriata* Stevens, *Pleurotomaria tabulata* Conrad, *Bellerophon carbonarius* Cox, *B. percarinatus* Conrad, and *Macrocheilus ponderosus* Swallow. Many other species also have been found associated with those which have been just named, but the latter are quite sufficient to characterize the strata containing them as belonging to the Coal-measure series. No attempt has been made to subdivide the Coal-measure series of Texas into upper, middle, and lower portions as has been done in the Upper Mississippi Valley, and they are probably not capable of such a subdivision in this southern region. The Lower or Subcarboniferous portion of the system has also not been recognized in Texas.

Along the western boundary of the Texas Permian, as it has been indicated in a previous paragraph, a series of strata, about 250 feet in maximum thickness, now generally known as the "gypsum-bearing beds" and thought by many to be of Triassic age, rests conformably upon the Permian. In general aspect, in a prevailing reddish color, and in general lithological character, except in the prevalence of gypsum in many of the layers and the somewhat greater prevalence of clayey material, these overlying beds resemble the Permian strata upon which they rest. With only one known exception these gypsum bearing beds have furnished no fossils. The exception referred to is the discovery by Mr. Cummins in Hardiman county, in an upper stratum of those beds, of a thin magnesian layer containing

⁴ Mr. Cummins informs me in an unpublished letter that he has distinguished no less than nine coal horizons there.

numerous casts of a species of *Pleurophorus*. This being a characteristic genus among Permian molluscan faunas and a prevailing form in the Permian strata beneath the gypsum bearing beds, the question is suggested whether the latter ought not to be regarded as constituting an upper portion of the Permian. If these beds are not separable from the Permian, it seems to be doubtful whether the Trias has any representation in Texas.

It will be seen from the foregoing remarks that in the part of northern Texas to which special reference has been made, there is a great conformable series of strata having a slight general dip to the westward, its base being covered from view by mesozoic and later formations. The estimated thickness of this older series, so far as it is exposed to view, is 3050 feet. The lower 1800 feet, together with an unknown thickness beneath, is referred to the Coal-measures. The next overlying 1000 feet of strata are designated as Permian; and the upper 250 feet of the series is doubtfully referred to the Trias, although as already intimated there seem to be reasons for regarding the latter beds as constituting the upper part of the Permian. Cretaceous strata rest unconformably, and with a contrary dip, upon the earlier eastern portion of this series; while upon the later western portion they rest with apparent conformity; although their real conformity there may be properly questioned because the Jura seems to be entirely wanting, and at most the Trias is only slightly developed.

As already stated, the Cretaceous strata appear to rest conformably upon the gypsum bearing beds; and the latter beds lie quite conformably with the Permian and Coal-measures beneath, all having a westward dip. On the contrary, all the beds from the Dinosaur Sands, which are regarded as the lowermost Cretaceous formation in Texas, to the Tertiary inclusive, have an easterly dip and seem to lie unconformably with the Coal-measures and Permian. It is not certain, however, that the Carboniferous and older strata do not dip to the eastward beneath the Cretaceous strata, forming an anticlinal axis. Having thus shown the stratigraphical relation of the Texas Permian with the other formations, the following remarks will be confined to the Permian alone.

The following descriptive section of the Texas Permian is taken from Mr. Cummins' field notes, but it has been in large part verified by my own personal observation. The different members of this section, which are indicated by consecutive numbers, are not

distinctly definable from one another, but the section is presented in this form for convenience in making reference to the respective horizons at which collections of fossils have been made.

DESCRIPTIVE SECTION OF THE PERMIAN OF TEXAS.

1. Reddish and mottled sandy clays, with occasional layers of sandstone.

2. Variously colored clayey and sandy concretionary strata, with a few irregular layers of impure concretionary limestone; embracing near its middle a somewhat persistent stratum of limestone of greyish blue color.

3. Sandstones alternating with clayey and sandy concretionary layers and a few fine grained silicious layers.

4. Reddish and buff colored clayey and sandy shales with occasional layers of sandstone.

5. Sandstones and sandy shales; with beds of reddish sandy clay; passing gradually into the Coal-measures beneath.

Vertebrate remains, which Prof. Cope confidently refers to the Permian, occur at numerous localities and at many horizons from the base to the top of this section; but invertebrate remains have hitherto been discovered only in strata which are included in Nos. 2 and 3 respectively of that section. The lowermost known horizon of invertebrates is about 400 feet above the base of the series, and the uppermost is about as much below the top of the same. That is, the invertebrate fossils described and figured in this article come from the middle 200 feet in thickness of the Permian series as it has just been defined.

The localities at which these fossils were obtained, only three in number, are in Baylor and Archer counties; and as the country is still an unsettled one, they can be designated only in an indefinite way. The first of these localities, which is in the northwestern corner of Archer county, will be designated as "Camp Creek." The second is in Baylor county, near the middle of its eastern boundary line, and will be designated as "Godwin Creek." The third is in the northeastern part of Baylor county, near where the old military road, constructed by General Van Dorn, crossed the Big Wichita river. This locality will be briefly designated as the "Military crossing of the Big Wichita." The strata of the two first mentioned localities occur in No. 3 of the foregoing descriptive section of the Permian, and the last named one, in No. 2.

The following is a list of all the invertebrate species which are now known to have been found in the Texas Permian, all of which are discussed on following pages. The list is presented in tabular form for the purpose of giving a synoptical view of the fauna, so far as it is at present known, and also to indicate the localities at which the respective species have been discovered, as well as their inter-association there. As to the latter condition, it is proper to state that specimens of all the species found at the locality which is indicated as the Military Crossing, were collected by myself from a single stratum, where they were found commingled in such a manner as to leave no doubt as to their having been all members of one and the same contemporaneous fauna. Specimens of the greater part of the other species were also collected by me at the localities indicated.

LIST OF SPECIES.

	Camp Creek.	Godwin Creek.	Military Crossing.
1. <i>Goniatites baylorensis</i> n. s.			X
2. <i>Ptychites cumminsi</i> n. s.			X
3. <i>Medlicottia copei</i> n. s.			X
4. <i>Popanoceras walcotti</i> n. s.			X
5. <i>Orthoceras rushensis</i> McChesney?			X
6. <i>Nautilus winslowi</i> Meek and Worthen.....			X
7. <i>N. occidentalis</i> Swallow.			X
8. <i>N. ————?</i>			X
9. <i>N. ————?</i>		X	
10. <i>N. ————?</i>			X
11. <i>N. (Endolobus) ————?</i>			X
12. <i>Naticopsis remex</i> White.		X	X
13. <i>N. shumardi</i> McChesney?		X	
14. <i>Euomphalus subquadratus</i> M & W.			X
15. <i>E. ————?</i>			X
16. <i>Murchisonia ————?</i>		X	X
17. <i>Patella ————?</i>		X	
18. <i>Bellerophon crassus</i> M & W.		X	X
19. <i>B. montfortianus</i> Norwood & Pratten		X	
20. <i>B. ————?</i>			X
21. <i>Sedgwickia topekaensis</i> Shumard sp		X	
22. <i>Pleurophorus ————?</i>		X	
23. <i>Clidophorus occidentalis</i> Geinitz		X	
24. <i>Voldia subscitula</i> Meek & Hayden.		X	
25. <i>Myalina permiana</i> Swallow ..	X	X	X
26. <i>M. aviculoides</i> M & H		X	
27. <i>M. perattenuata</i> M & H	X	X	X

28. <i>Gervillia longa</i> Geinitz.....		X	
29. <i>Aviculopecten occidentalis</i> Shumard.....			X
30. <i>Syringopora</i>?	X	X	
31. <i>Spirorbis</i>?			X
32. <i>Cythere nebrascensis</i> Geinitz.....			X

SUMMARY.

Mollusca.	{ Cephalopoda.....	11 species.
	{ Gastropoda.....	9 "
	{ Conchifera.....	9 "
Articulata.	{ Vermes.....	1 "
	{ Crustacea.....	1 "
Radiata....	Polypi.....	1 "
Total,		32 "

By reference to the foregoing list of species, and especially to the summary at the foot of the list, it will be seen that the invertebrate collections which have hitherto been made from the Permian formation of Texas, do not represent a fauna in its usual proportions, as regards the classes and families to which the species respectively belong. This is especially true when we compare these collections with Permian faunas already known in other regions. For example, it will be seen that the Cephalopoda are in unusually large proportion, that the Brachiopoda and Polyzoa are absent, and that the Polypi are represented by only a single species. In short, it is plain that the invertebrate fauna which existed during the period in which the Texas Permian was deposited, and in the same, or in contiguous waters, is imperfectly and disproportionately represented by these collections.

Some of the causes of the imperfection and disproportion referred to, are too plainly apparent to need extended comment, and others are suggested by the lithological and stratigraphical character of the formation in which the remains are found. Besides the inevitable causes of imperfect representation of extinct faunas by their remains, a conspicuous reason for the imperfection of these collections is that the formation has yet been carefully examined in only a small part of the large region which it is known to occupy, and an exhaustive search for invertebrate fossils has yet been made at only a few of the localities which have been visited by competent collectors.

Again, there are few strata entering into the composition of the Texas Permian where it has been examined, the character of which indicates that they successively formed the bottom of waters where at least a large proportion of then existing invertebrates

could not have found a congenial habitat. That is, sandy and other silicious strata, as has already been shown, prevail in this formation, while calcareous strata are comparatively rare. It is true that certain families, especially of the Mollusca, find a silicious, sandy bottom, such as the material of most of those strata doubtless formed, more congenial than a muddy or calcareous one; but to far the greater part of all invertebrate faunas the latter kind of bottom, other conditions being favorable, is much more congenial. In short the lithological character of a formation often presents obvious reasons not only for the comparative paucity of all invertebrate fossils in its strata, but even for the absence of representatives of certain families which we have every reason to suppose existed when they were deposited, but in other, not far distant places, and in more congenial waters.

But these collections, imperfect as they are, present subjects for consideration which are of far greater interest than that which attaches to a mere addition to our knowledge of a few of the forms which constituted the fauna of any given epoch or period. Such, for example, as the relation which the fauna of one period in a given region bore to faunas which were presumably contemporaneous with it, and to those of the periods which immediately preceeded and followed it; and the indication which these fossils give as to the geological age of the strata containing them.

Three of the Cephalopod species, the names of which are given in the foregoing list, are represented on the accompanying plate, and brief descriptions of them follow.

Ptychites cummingsi n. s. Plate I figs. 4, 5, 6, 7 and 8.

Shell compressed-subglobose, volutions deeply embracing, umbilici small; septa numerous and complex, the suture line as represented by fig. 8.

Medlicottia copei n. s. Plate I, figs. 1, 2 and 3.

Shell thinly discoid, periphery narrow, medially grooved, umbilici small; volutions deeply embracing; septal suture as shown by fig. 3.

Popanoceras walcotti n. s. Plate I, figs. 9, 10 and 11.

Shell discoid; periphery deeply embracing; umbilici minute; surface marked by slightly sinuous radiating lines or indefinite ridges; septal suture as shown by fig. 11

The other species which is definitely recognized as new is a *Goniatites* whose general character is not unlike that of known Carbon-

iferous species. The *Ptychites* and *Popanoceras* may be properly regarded as of mesozoic type, such as might be expected to occur in Triassic strata. The *Medlicottia* is the first species of the genus to be discovered on this continent, and has been usually regarded as indicating the later Carboniferous, or Permian age, of the strata containing the genus.

EXPLANATION OF PLATE I.

MEDLICOTTIA COPEL.

- Fig. 1. Lateral view.
 " 2. Outline showing transverse section of volutions.
 " 3. Suture line.

PTYCHITES CUMMINSI.

- " 4. Lateral view of a small example.
 " 5. Peripheral view of the same.
 " 6. Lateral view of a larger example.
 " 7. View of a septum of a larger example.
 " 8. Suture line of the same.

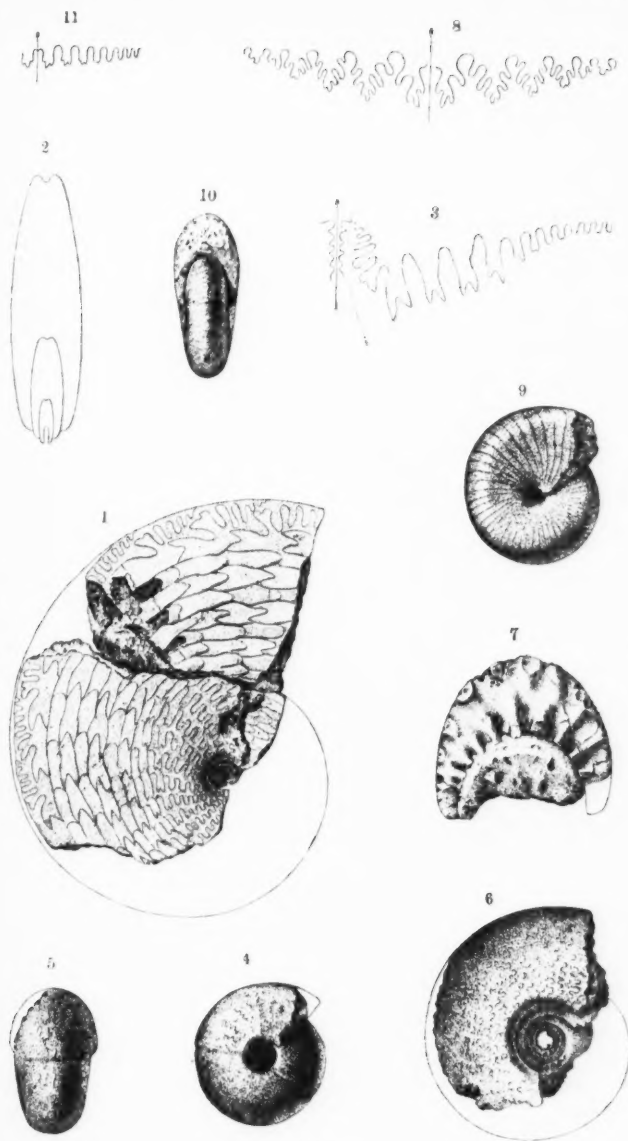
POPANOCERAS WALCOTTI.

- " 9. Lateral view of a small example.
 " 10. Peripheral view of the same.
 " 11. Suture line.

All the figures are a little less than natural size.

It will be seen from the foregoing descriptions and notes, that of the 32 species of invertebrates which are represented in the collections from the Texas Permian, only four of them are recognized as new, all of which are cephalopods, and all belong to the Ammonoidea. The others have either been previously described and published, or their specific identity with published forms is in doubt because of their imperfection, either of the specimens in hand, or of the manner of publication of the species which they probably represent. Fifteen of these Texan species are satisfactorily recognized as having been previously published, a part of which have been by some authors referred to the Permian, but the Coal-measure age of the remainder has never been questioned. Some authors also assert that not only all of the fifteen species just mentioned, but all North American invertebrate species which have ever been referred to the Permian, are really members of the fauna which characterizes the Coal-measure period. Indeed, so generally has this view prevailed during the last twenty years, that if the four new cephalopods before mentioned were not present in the Texan

PLATE I.



Permian Cephalopoda.



collections, no American paleontologist who is familiar with the Coal-measure fauna, would probably have hesitated to refer them all to that period.

It is doubtless true that because so large a proportion of the invertebrate species, which have been obtained from reputed Permian strata in North America, occur also in characteristic Coal-measure strata, no satisfactory separation of them into two groups has hitherto been practicable upon the evidence of invertebrate fossils; and stratigraphical evidence has hitherto been unsatisfactory also. The collections, however, which are represented by the foregoing list and descriptions, although consisting mainly of Carboniferous forms, contain at least two types which are so generally regarded as indicating the Mesozoic age of the strata containing them, that if they alone, and without any statement of correlated facts, had been submitted to any paleontologist, he would not have been warranted in referring them to an earlier period than the Trias, if he had followed the usually accepted standard of reference. These two forms have been described on preceding pages, under the names of *Ptychites cumminsi* and *Papanoceras walcotti* respectively; and with the exception of the *Ammonites Parkeri*⁵ of Heilprin, also from Texas, similar types have never been found associated with recognized Carboniferous species in North America.

This, however, is by no means the first, nor the most important discovery of the commingling of Mesozoic and Paleozoic types in such a manner as to indicate that they all lived contemporaneously, and were members of one and the same fauna. The remarkable discovery by Professor Waagen, in India, of⁶ many molluscan species belonging to mesozoic types associated with a characteristic Carboniferous fauna is well known. It is also well known that mesozoic characters are recognizable among certain of the Carboniferous and Permian cephalopods of Russia and Armenia, as well as of certain parts of Europe.

The special interest which these Texan collections possess lies, first, in the presence of the two cephalopods of mesozoic type as members of an invertebrate fauna composed otherwise of paleozoic types; and second, in the association of this invertebrate fauna with a vertebrate fauna composed mainly of Permian types, as de-

⁵ Proc. Acad. Nat. Sci. Phila. 1884, vol. XXXVI, p. 53.

⁶ See Paleontologia Indica Series XIII; Salt Range Fossils.

terminated by Professor Cope, and in the known superposition of the formation containing these faunas upon characteristic Coal-measure strata. The first point of interest relates to the interdelimitation of the Mesozoic and Palæozoic; and the second, to the assumed Permian age of the Texan formation from which the collections referred to were made.

The biological interdelimitation of the Mesozoic and Palæozoic ages in geological history has long been regarded as clearly recognizable in all parts of the world. While it was well known that a considerable number of generic forms, especially of the invertebrates, respectively occur in strata of both ages, palæontologists have generally regarded it as a fundamental fact that certain orders, families, and even genera, which possess certain characteristics of structure and form, were rigidly confined to each age respectively. That is, they believed that the types which fall into the one category all ceased to exist at the close of the Palæozoic age, and that no member of the other category began its existence before the opening of the Mesozoic age. The presence of remains belonging to either the one or the other of these categories was therefore regarded as affording unquestionable proof of the geological age of the strata containing them. Attempts were made to explain the first discoveries of the commingling of earlier and later types in one and the same stratum, by assuming that the specimens showing the earlier types of structure were derived in an already fossil condition from pre-existing strata in the process of their destruction by which the materials for new strata were produced.

However unphilosophical those views concerning the chronological restriction of certain types may appear in the light of modern biology, it is not to be denied that until within comparatively few years paleontological observations in the field seemed, as a rule, to favor them. These later discoveries, important instances of which have been referred to, show conclusively that animals belonging to both the categories which have just been indicated lived contemporaneously. It furthermore appears that some of those which have been regarded as exclusively mesozoic in character began their existence while yet Palæozoic forms were far in the ascendant; and also that many Palæozoic types survived their earlier associates and lived in association with Mesozoic faunas. As I shall discuss this subject in another publication, it need not receive further consideration here; but I offer in following paragraphs some general re-

marks upon the reputed North American Permian, in the course of which reference will be made to the bearing which the presence of Mesozoic types among the Texan Permian fossils has upon the question of the geological age of the strata containing them.

From time to time during the past thirty years there have been discussions among geologists as to whether there is in North America any true equivalent of the Permian formation of Europe. Some writers have been uncompromising in their advocacy of the affirmative side of this question, and others have been equally positive in asserting the negative. Much of this difference of opinion has arisen from imperfect knowledge of essential facts, and much from want of a clear definition by the respective writers as to what they have regarded as constituting equivalency in this case. Although much addition has within the past few years been made to our knowledge of facts bearing upon this question, and it is evident that clearer views upon it are now generally held than formerly prevailed, it is too much to expect that the views of all geologists should even now fully agree. The following statement of the present condition of this question, as the writer understands it, is presented that the reader may understand more clearly his views, and the reasons for the conclusions and opinions which are expressed in this article.

In Europe the Carboniferous system is understood to be divided into three great groups, namely, the Lower Carboniferous, the Coal-measures and the Permian, which are definable from one another, not only by palæontological, but by stratigraphical characteristics. In North America, the great Carboniferous system is quite as largely developed as in Europe. The Lower Carboniferous and Coal-measure groups are, upon both stratigraphical and palæontological grounds, as clearly recognizable and distinguishable from each other, in some parts of this continent, as they are in Europe, but the Permian has hitherto had no such undisputed recognition. Therefore, the question now to be considered is whether the Permian of Europe has really an equivalent anywhere in North America; and if so, how that equivalency is recognizable.

There are seven principal regions in North America within which strata occur that have been by different authors referred to the Permian. These are (1) southwestern Pennsylvania and northern West Virginia; (2) Prince Edwards Island; (3) eastern Illinois;

(4) northeastern Kansas and southeastern Nebraska ; (5) South Park, Colorado ; (6) isolated portions of New Mexico, Arizona, Utah and Western Colorado, and (7) northern Texas and the adjacent part of Indian Territory.

In all these cases there seems to be no room for doubt that the strata in question are not older than the Upper Coal-measures, as that formation is distinguishable in North America, but aside from their evidently high position in the Carboniferous system, their recognition as Permian has been based upon different kinds of evidence in each case. In the first and second mentioned cases it was based wholly upon plant remains ; in the third, upon vertebrate remains alone ; in the fourth, upon invertebrate remains ; in the fifth, upon plants and insects,⁷ and in the sixth, mainly upon stratigraphical position. The evidence in favor of the recognition of the strata, as constituting a separate formation in the seventh case, is presented in this article.

Two general ideas seem to have prevailed respectively in the minds of those who have considered the question of the recognition of the Permian in North America. On the one hand, the discovery on this continent of remains belonging to generic or other types of vertebrate, invertebrate, or plant life, which are respectively similar to forms found in the European Permian, have been regarded by some authors as surely indicating in each separate case the Permian age of the strata containing them, even in the absence of, or without regard to, correlated facts, whether paleontological or stratigraphical. On the other hand, it has been contended that no definite recognition of the Permian, even in the first-mentioned cases, ought to be made until after due consideration of all obtainable correlated palæontological and stratigraphical facts ; and not then, unless the preponderance of all that evidence should plainly favor such recognition.

The untenableness of the position indicated in the case first stated is shown by the facts mentioned in preceeding paragraphs of the occurrence in one and the same stratum of forms which have been held to be characteristic of separate geological periods, and even of separate ages. It is conspicuously shown in the case of the Texan formation, which is specially discussed in this article, be-

⁷ These insects, however, have been by Scudder referred to the Trias, although they are associated with the most characteristic Permian flora that has yet been discovered on this continent.

cause both its Coal-measure and Triassic age can be even more readily proved, in an *ex parte* way, by special selections from its fossils, than its Permian age. And yet the sum of all the evidence is in favor of the latter.

The following paragraph from the work of Professors Wm. M. Fontaine and I. C. White tersely states¹ the principle which ought to govern the investigator in these cases, although it was written only with reference to the Permian character of the flora which they were then investigating.

"It is good evidence that we have to deal with a more recent formation, when we find it to show a decadence of old forms, and an introduction of new ones, destined to reach their culmination at a later period. Thus if we find, in a series of rocks, plants characteristic of the Carboniferous formation, and perceive that these die out and disappear, we should not conclude from their mere presence that the age of the strata is Carboniferous, but rather that it is Permian. So also the finding of genera and species, even identical with those of the Trias or Jurassic, would not necessarily imply a Triassic or Jurassic age. If we find them to be exceedingly rare, their presence is rather indicative of a formation older than the Trias or the Jurassic. It is only by taking into consideration all the above named characters and other points which may be presented by the entire body of specimens, that we can determine the nature of the evidence offered by the life of a formation. It will not suffice to say arbitrarily that this or that feature is without value as evidence. Circumstances might reverse the normal relative weight of evidence from the several sources, and give preponderating weight to what would, if unaffected by them, have slight value."

Besides the observance of this principle, the investigator should remember the entire improbability that distinguishing types could have been simultaneously introduced in all parts of the world; and the no less evident fact that certain types in different parts of the world long survived their extinction in other parts. He should also bear in mind the now evident fact that the rate of progressive development of vertebrate, invertebrate and plant life respectively has not been uniform in all parts of the world. It therefore ought not to be expected that precisely the same associa-

¹ *Permian or Upper Carb. Flora of West Virginia and S. W. Pennsylvania. Second Geol. Surv. Penn. Rep. Prog. P. P., pp. 109, 110.*

tion of types would be found on this continent that occur in Europe and elsewhere.

Much difference of opinion has prevailed even among those who recognize the importance of considering all the facts which bear upon a given case of assumed equivalency. Some have believed that it should be strictly chronological as regards the whole of a given formation; while others claim that the most we can reasonably assume in any case is approximate contemporaneity, and all that we can ever certainly know in such cases is the homotaxial relations of formations in different parts of the world respectively. The scope of this article, however, will admit of only a partial discussion of those views.

If all the time which is represented by the entire Carboniferous system in Europe is represented by the entire Carboniferous system of North America, the Permian of Europe must necessarily have a complete time equivalent somewhere on this continent. If that system is everywhere incomplete at the upper limit on this continent, and the same is complete in Europe, it necessarily follows that the stratigraphical time equivalent of the European Permian is either absent or incomplete in North America. But all the known facts which bear upon this case are of such doubtful value in their application to the question of strict chronological equivalency that it seems to be unprofitable to discuss it. Therefore the only question that remains to be considered in this connection is that of homotaxy.

The question, even after being reduced to these limits, is a complex one, for it still involves the consideration of conflicting and disagreeing paleontological evidence as well as a recognition of upper and lower delimiting boundaries of the formation. There can be no good reason for doubting that there are in various parts of North America strata which are homotaxially equivalent, at least in part, with the Permian of Europe. But it is equally true that much of the reputed North American Permian cannot be satisfactorily separated from the Coal-measures, and even those which have been separated more or less satisfactorily, are found to be so intimately related to the Coal-measures as to make the lower limit indefinable.⁹

⁹ In view of the last mentioned condition, several American and European writers have applied the compromising term "Permo-Carboniferous" to that undefinable upper portion of the Carboniferous system. Unfortunately, however, some American authors have of late applied the same term to the whole Carbonif-

Heretofore it has been impracticable to say whether the upper limit of the Carboniferous system in North America is complete or not. For example, none of the reputed Triassic strata, which occur in various parts of the continent, have been found in such relation to the reputed Permian as to indicate that there was continuous sedimentation from the one formation to the other; nor have those Triassic strata been found to contain any conclusive palæontological evidence of their immediate succession to the Permian. Indeed, as regards the remains of invertebrate life, the existence of any Triassic strata in North America rests upon comparatively slight evidence; slighter, indeed, than it might have seemed to be before the discovery of Triassic types associated with well-known Carboniferous forms.¹⁰

The conflicting character of a part of the evidence afforded by the reputed North American Permian as to its age has already been shown, but there is an important case of want of harmony of different portions of certain accepted paleontological evidence that deserves mention. In Professor Cope's systematic catalogue of the Permian vertebrate fauna of North America,¹¹ he shows that it has been discovered mainly in two limited districts, one in eastern Illinois and the other in Texas. His catalogue also shows that of the 76 species enumerated, not one, and of the 32 genera only five, are common to the two districts. He also states that "the Permian vertebrate fauna of Illinois and Texas exhibits close parallels, but not yet generic identity on this continent."¹²

On the contrary, the marine invertebrates which characterize the North American Coal-measures, a part of which usually range up into the reputed Permian, are widely distributed on this continent,

erous series; seeming thereby to imply that the series includes an inseparable equivalent of the Permian, as well as the remainder of the system.

¹⁰ The Triassic character of a part of the Permian fauna of Texas has been sufficiently stated, but it is also true that certain Carboniferous types occur in the Meekoceras beds of southeastern Idaho. Besides this, those beds appear to have an intimate stratigraphical relation with the characteristic Carboniferous strata beneath them. Add to these facts the further one that types similar to those which have been relied upon in referring the Idaho beds to the middle Trias, also occur in undisputed Carboniferous strata, and it seems possible that those reputed Triassic beds ought to be referred to the Permian rather than to the Trias.

¹¹ Trans. Am. Philos. Soc. vol. XVI, pp. 285-288.

¹² See Vol. III., Book I. U. S. Geol. Surv. Terr., p. 25.

and their geographical range includes both the Illinois and Texan vertebrate localities. That is, the invertebrate fauna referred to is uniform over a region in which the vertebrate fauna is diverse.

In all the vertical and geographical range of these invertebrate fossils, there has never been observed any evidence of the decadence of old forms¹³ such as would be taken to indicate an approaching close to the geological period which they have especially characterized; and it is only in the case of the Texan Permian that an introduction of new forms has been yet observed which might be regarded as forerunners of a new one.

Finally, while it is freely admitted that a considerable number of the invertebrate species which characterize the Permian of Europe have nearly related representatives on this continent, it should not be forgotten that they are as characteristic of our undisputed Coal-measures as of the reputed Permian. Even if those forms are really specifically identical on the two continents it does not necessarily prove the contemporaneity of the respective formations containing them. In fact those formations must be necessarily of a difference in age equal to the time required by the distribution of the species.

The recognition of the Permian of Texas as a separate upper group of strata belonging to the Carboniferous system is based upon both stratigraphical and palæontological evidence, and this evidence is fuller than that which has been adduced in favor of any other reputed Permian strata of North America. First, it contains invertebrate species which have been referred to the Permian in other districts to the northward, some of which are closely related to Permian species of Europe. Second, it contains the large vertebrate fauna published by Professor Cope, which he regards as characteristically Permian. Third, the Texan formation evidently constitutes an upper, apparently the uppermost, portion of the Carboniferous system. Fourth, the lithological difference between this formation as a whole and the Coal-measures beneath it

¹³ It has been pointed out by some authors that certain of the brachiopods and other species which characterize the Coal-measures, have never been found in any of the reputed Permian strata, and it seems to have been assumed that their absence was due to a final decadence of those forms before the Permian period was reached. It seems, however, not at all unreasonable to infer that successive changes of conditions differently affected different classes of animals, in consequence of which the forms referred to were not extinguished, but only differently dispersed.

is sufficiently marked to make it conveniently distinguishable by the eye. Besides this, the mesozoic element which has been shown to exist among the invertebrates of the Permian of Texas may be properly regarded as holding an opposite relation to the Palæozoic element, and thus to suggest a balance of palæontological evidence in favor of the Permian age of that formation.¹⁴

The present state of our knowledge, or warranted opinion, as to the existence of the Permian formation in North America may be summed up briefly as follows :—

Although the two earlier groups of the Carboniferous system, namely, the Lower Carboniferous and Coal-measures are as clearly recognizable in the region traversed by the Mississippi river as they are in Europe, in many parts of this continent where Carboniferous strata are largely developed no distinctive recognition of either of those groups, or of the Permian, is practicable.

In those regions where the Coal-measures or their equivalent strata are recognizable, certain strata are sometimes found resting upon them which have been referred to the Permian; but those strata are as a rule, not distinctly separable from the Coal-measures upon either stratigraphical, or palæontological ground. That is, no distinct stratigraphical plane of demarkation between the Coal-measures and the reputed Permian is observable. Besides this, many of the common Coal-measure species range up into those Permian strata, and many acknowledged Permian types, according to the European standard, occur in the unquestioned Coal-measure strata beneath them.

The upper limit of the Carboniferous system and the lower limit of the Trias, have never been clearly recognized upon this continent, and it is therefore not yet known that either of these systems are here at any point complete in that respect. But the upper limit of the Carboniferous system is known to be incomplete at most places where strata of that age occur.

Notwithstanding the mezozoic character of some of the fossils found in the reputed or true Permian strata the relationship of all these strata, both palæontologically and stratigraphically, is far more intimate with the Carboniferous than with the Trias.

14. The value of this suggestion is somewhat lessened by the known presence of the *Ammonites parkeri* of Heilprin in the underlying Texan Coal-measures, and by the presence of similar types beneath the Permian in certain parts of the old world. Still, such forms as *Ptychites cumminsi* may properly be regarded as immediate harbingers of the Mesozoic age.

A large part of the North American strata which have been by various authors referred to the Permian have no valid claim to be either so considered, or as being separate from the upper Coal-measures. But a part of them may be reasonably assumed to be homotaxially equivalent with at least a part of the European Permian ; although their delimitation from the Coal-measures may in most cases be difficult or impracticable.

The evidence upon which the Texan strata have been referred to the Permian is fuller than that which has been adduced with regard to any other North American strata, that have been so referred. That is, the evidence of both vertebrate and invertebrate fossils is in favor of such reference, and the difference in the character of the strata from those of the underlying Coal-measures, although not great, is conveniently distinguishable. Still, it is true that the Texan Permian strata bear many Coal-measure invertebrate species ; and its flora is at present unknown.

ON THE MAMMALIA OBTAINED BY
THE NATURALIST EXPLORING EXPEDITION
TO SOUTHERN BRAZIL.

BY E. D. COPE.

THE Naturalist Exploring Expedition left New York for Southern Brazil in the year 1882, and landed at Porto Alegre in the department of Rio Grande do Sul, with the object of making collections in that province.¹ It was under direction of Herbert H. Smith, whose former service under Prof. Frederick Hartt in the Geological Survey of Brazil, had given him ample acquaintance with the people and language. Regular collections were first made at the village of Sao Joao do Monte Negro, on a tributary of the Ura-

¹ Articles descriptive of this region by Mr. H. H. Smith will be found in the *AMERICAN NATURALIST*, 1883, pp. 480, 707 & 1007.

guay River, in the western centre of the province, in about lat. 28° south. After a residence there of several months, Mr. Smith and party proceeded north-west to the interior province of Matto Grosso, ascending the Paraguay River to Cuyaba. From Cuyaba the party went about thirty miles to the north-eastward, to the little village of Chapada, where they remained for months. This locality was especially favorable for the objects of the expedition, being on the boundary line between the great plains to the south and the forest-covered mountains on the north, and at the heads of the drainage of the Paraguay to the south, and of the Xingu tributary of the Amazon on the north, at about lat. 15° S.

The difference in the characteristics of these localities is easily observable in the collections obtained from them. I have already published reports on the Batrachia and Reptilia from both localities,¹ and the present report embraces the Mammalia. The insects and birds are in the Museum of Natural History, Central Park, New York. Researches on the Mammalia of these regions have been already made by Hensel² and Von Jhring in Rio Grande do Sul, and by Natterer at Cuyaba. The collections of the last-named explorer are worthily described by Wagner of Munich, and a full report on them has been made by Von Pelzeln. ‡ of Vienna. Sixty-five species were obtained by Mr. Smith, most of them represented by many specimens, and five of the species appear to be new to science. The distribution of these as to locality will be stated at the close of the paper.

MARSUPIALIA.

1. DIDELPHYS MARSUPIALIS AZARÆ Temm. (Thos.)

Two skins with skeletons from Sao Joao; three skins with skeletons from Chapada; one skin with skull from Sao Joao; two skins from Chapada, two from Sao Joao, and four without locality; also one skeleton from Chapada, two skulls from do, three skulls from Sao Joao, and two skulls and a skeleton of unknown localities.

2. DIDELPHYS MARSUPIALIS AURITA Wied. (Thomas).

One skin from uncertain locality. Although fully grown, the long dorsal hairs and the ears are perfectly black, and there are large spots above the eyes. Belly light brown.

¹ Proceedings American Philosophical Society, 1884, p. 185; 1887, p. 44.

² Memoirs of the Akad. Wissensch. Berlin 1872. ‡ Zoolog. Botan. Gesselsch. Wien, 1883.

3. PHILANDER PUSILLUS Desm.

A specimen in alcohol, and a skeleton, probably of this species, from Chapada.

The generic name Philander is used here for the opossums without marsupial pouch, without regard to other characters.

4. CHIRONECTES MEMINA Cuv.

One skin with skeleton from Chapada.

CHIROPTERA.

PHYLLOSTOMIDÆ.

5. PHYLLOSTOMA HASTATUM Pallas.

Chapada.

6. CAROLLIA BREVICAUDA Weid.

Chapada.

7. ARTIBEUS PLANIROSTRIS¹ Spix.

Chapada.

8. ARTIBEUS BILOBATUS Peters.

Neither of the two specimens from Chapada agree with the description given by Professor Peters in all respects. The edge of the lancet of the nose-leaf is not crenulate, and the border of the horse-shoe is but slightly lobed. In all other respects the specimens agree with the descriptions. The degree of the lobing of the edge of the

¹ DERMANURA EVA sp. nov.

Founded on two adult males from the Island of Saint Martins, West Indies.

Dentition, I. $\frac{2}{2}$; c. $\frac{1}{1}$; pm. $\frac{2}{2}$; m. $\frac{2}{2}$. Median upper incisors emarginate; all the inferior incisors emarginate. Lip tubercles as usual in this genus and Artibeus, those of the permaxillary region narrow and separated by vertical plicæ, and without an interior row of rounded warts as in *A. planirostris*. Inferior border of horse-shoe free and not appressed, its lateral borders once undulate. Ear laid forwards reaching to middle of eye. Tragus acuminate, widest at the middle, triangular in section, the edge external. Interfemoral membrane notched to a line opposite to the middle of the tibia. Hind legs and feet, interfemoral membrane to line of knees, and proximal half of fore-arm, with a sparse silky fur. Wing membrane furred to middle of femur above and below. General color brown, reddish tinged on the limbs and head. Sides of head a pale shade, above each eye to inner side of ear, paler.

Length of head and body, m. .079; of interfemoral membrane to notch, .012. Length of head .032; of leaf of muzzle, .0125; of fore-arm, .059; of tibia, .021; of posterior foot, .017.

According to Dobson, this species approaches nearest to the *D. quadrivittata*, but it differs in its much superior size and in the different form of the external incisor tooth. It is as large as the *Artibeus planirostris*, Dr. R. E. Van Rijgersma.

horse-shoe may be variable; and I observe some crenation of the edge of the same in some specimens of the *Vampyrops lineatus* which is wanting in other specimens.

9. *VAMPYROPS LINEATUS* Geoffroy.

Chapada.

10. *STURNIRA LILIUM* Geoffroy.

Chapada.

EMBALLONURIDÆ.

11. *MOLOSSUS RUFUS* Geoffr.

One specimen from Sao Joao.

12. *NYCTINOMUS BRASILIENSIS* Is. Geoffr.

Four specimens from Sao Joao.

VESPERTILIONIDÆ.

13. *VESPERUS ARGE* sp. nov.

Dentition I. $\frac{2}{3}$; c. $\frac{1}{1}$; Pm. $\frac{1}{2}$; m. $\frac{3}{3}$. Inferior incisors trilobate, placed transversely to the mandible; superior incisors unequal, the external simple, narrow, not quite so long as either lobe of the internal, and placed close to it and to the canine. "First" (second) inferior premolar much smaller than second, and in line with the latter. Ears much shorter than the head, when laid forwards reaching a short distance in front of eye, near the apex. Helix openly notched on the external margin, which is thus turned outwards and obtusely rounded. Tragus convex, separated from helix by a very open emagination. Antitragus elongate lanceolate, with the greatest width near the middle, and with a rounded lobe at the external base. Lateral swellings of the muzzle large, covered with sparse hair. At their anterior extremity and just above the nostril is a deep fossa which is connected by a groove with the nostril, giving the appearance when closed of an oblique slit-like nostril, as in *V. platyrhinus* of Dobson. No tubercles on the soles. Interfemoral membrane inclosing all the caudal vertebræ, which terminate in a short free cataginous apex. Wing membrane to base of hallux. Calcaneum long; postacalcaneal lobe distinct, narrow. Tibia elongate. Fur extending on the wing membranes by a narrow border only above and below, not extending on interfemoral membrane. Antebrachial membrane not reaching middle of fore-arm.

Color above dark brown tinged with reddish; below similar, the hairs with lighter brown tips. Inferior side of interfemoral mem-

brane pale or milky, the color becoming less decided towards the margins.

Length of head and body m. .061; of tail .038; of head .020; of hind foot, .010; of third digit, .071.

One ¹ from Sao Joao.

EDENTATA

MYRMECOPHAGIDÆ.

14. MYRMECOPHAGA JUBATA Linn.

Four skins with skeletons, and three skulls, from Chapada.

15. MYRMECOPHAGA BIVITTATA Desm.

Two skins with skeletons, and two skeletons and a skull from Chapada; one fresh skin purchased at Sao Joao.

16. MYRMECOPHAGA BIVITATTA STRAMINEA sp. nov.

This species is represented by a nearly perfect skin in good preservation. Its proportions are much as in the *M. bivittata*, including the relative length of the tail. The internal claws are smaller than in the common species. The most obvious peculiarity is the color. This is a general straw-color, uninterrupted excepting by two black bands on the shoulders, and a black patch on the middle of the abdomen. The black bands commence immediately in front of the shoulders, and extend posteriorly over them, and terminate above a point about an inch posterior to the axillæ, converging very slightly, or nearly parallel. A blackish band passes from the eye, which it surrounds, to the muzzle. Claws dark horn-color.

Measurements of skin in normal proportions.

	M.
Length to base of tail (below).....	.410
" of tail.....	.365
" from end of muzzle to eye.....	.055
" " " to ear.....	.095
" of ear.....	.028
" of fore leg.....	.153
" of second claw (chord).....	.016
" of third claw (chord).....	.037
" of hind leg.....	.150
" of sole of hind foot (exclusive of claws).....	.069
" of posterior fourth claw.....	.015

¹ In a cave near Chapada, Mr. Smith found skulls of species of bats of the genera *Molossus*, *Phyllostoma*, and *Chiroderma*.

Burmeister (Thiere Brasiliens) refers to specimens of the *M. bivittata* in which the black of the dorsal regions is very much reduced in extent.

The type specimen is not fully grown I suspect. The label has been lost, so that I do not know whether it was obtained at Sao Joao or at Chapada.

17. MYRMECOPHAGA ?SELLATA¹ Cope.

A skin from Chapada resembles almost exactly this species or sub-species, in coloration, differing only in the non-continuation of the median yellow dorsal stripe to the yellow of the rump. But unfortunately it lacks the end of the tail so that the length of this part cannot be ascertained. I therefore refer it here with doubt.

Two specimens from French Guiana are in the Museum of the Academy of Natural Sciences in this city. They are grizzled straw-color, and have no black bands or spots. The hair of the entire superior regions is black at the base. The tail, is as long as the head and body together. These animals I suppose to belong to the *M. longicaudata* of Schreber, but the tail is not twice as long as the body

¹ MYRMECOPHAGA SELLATA sp. nov.

This species is founded on a skin which I obtained from Dr. Fritzgaertner, who brought it from Honduras and displayed it in the exhibit from that country at the World's Exposition at New Orleans. It is characterized by its long tail and peculiar coloration, exhibiting characters between the *M. longicaudata* of Wagner and the *M. bivittata*. While the tail is as long as the body in the latter, it is said to be nearly double that length in the former. In the *M. sellata* it is at least equal to the head and body together, but as the extremity is wanting it may have been longer. The hairs on the extremity of the tail are very sparse.

The color is characteristic. The ground is straw-color. An oblique black band commences on the front of the upper arm and extends upwards and backwards over the shoulder, and converges rapidly towards its fellow. They do not, however, meet, but each is continuous with a large black patch which covers the back and sides on each side of a narrow median band of the light ground-color. These patches extend posteriorly above to the end of the lumbar region, and then the boundary runs obliquely forwards on each side to the groin. This leaves the thighs, rump and tail of the pale ground color, regions which are black in the *M. bivittata*. The dusky color in front of the eye is very indistinct. The feet and end of the muzzle have been unfortunately cut off from this specimen, so that their characters cannot be ascertained. The length of the body to the base of the tail is 0.400 m. ; length of tail, .515 m.

Besides the three skins above mentioned, there are two of the *M. bivittata* in the Museum of Philadelphia, one from the Magdalena River, and one from Brazil.

as Gray states, but as long as the head and body, as in the *M. sellata*, and considerably exceeding that of the *M. bivittata*.

DASYPODIDÆ.

18. XENURUS GYMURUS, Illiger, 1815.

Three skins, with skeletons, one from Sao Joao, and one from Chapada.

19. XENURUS HISPIDUS Burmeister.

Twelve individuals, all from Chapada: evidently abundant, and constant in its characters.

20. DASYPUS SEXCINCTUS Linn.

Two skins, five skeletons, and nine skulls, all from Chapada.

21. PRIODONTES MAXIMUS Kerr.

One individual complete, and one skull from Chapada.

22. TATUSIA PEBA Desm.

Two skins, with skeletons, from Sao Joao ; one skin with skull, four skeletons and nine separate skulls, all from Chapada.

23. TATUSIA MEGALOLEPIS sp. nov.

Movable bands, six ; transverse bands or rows on the scapular shield, counted near the border, and omitting the large posterior row, twelve. Transverse rows on the pelvic shield, counted near the border, twelve, without the anterior wide marginal row. Tail considerably shorter than body, cylindric to the end. No rudimental thumb on the forefoot. Ears one-third as long as head. Two short hairs issuing from each scute of the movable rings. Hair of inferior surfaces very sparse.

Measurements.

	M.
Length of carapace (axial).....	.197
“ of shield of head.....	.055
Width between orbits.....	.026
Length of ear.....	.025
“ of tail.....	.166
“ of fore leg.....	.052
“ of third claw of fore foot (fourth).....	.017
“ “ “ hind foot.....	.012

The large size of the scales distinguishes the *Tatusia megalolepis* from the *T. peba* and the *T. hybrida* at all ages. The number of scuta in a movable band in the former is only 43, while in both the latter the number ranges from 57 to 60. It resembles the *T. hybrida* in the short tail,

but differs from this species in its longer ears, which are quite as in the *T. peba*, and also in the rounded and not angulate posterior border of the head shield, with one and not two rows of scales. The skull displays some slight differences from that of the *D. peba*. One character appears to be of value. The pterygoids are produced towards the median line, so that their opposing edges are parallel and separated by a fissure only, and this fissure is continued on the middle line into the palatine bone for a distance of nearly 2 mm. In all of my numerous skulls of *T. peba*, the pterygoid borders are either divergent or are separated by a wide space, and the palatines are not notched posteriorly. The palate is flat, with the borders rounded, and not recurved.

A single specimen with skeleton from Chapada.

RODENTIA.

SCIURIDÆ.

24. *SCIURUS ÆSTUANS* Linn.

One skin with skeleton, one with skull, and one entire skeleton, from Sao Joao.

25. *SCIURUS VARIABILIS* Geoff. var *Langsdorffii* Natt.

Four skins with skeletons, four skins with skulls, nine separate skins, and four separate skulls, all from Chapada.

Mr. J. A. Allen refers the *S. langsdorffii* of Natterer to this species as a color variety. All of the above seventeen skins are identical in color, showing that if it is but a variety, it is very constant in this locality. I may add that of the eleven skulls of the collection, all have but one superior premolar, and not two as given by Mr. Allen for the *S. variabilis*.

MURIDÆ.

26. *CRICETUS* sp.
Chapada.

27. *CRICETUS* sp.
Chapada.

28. *CRICETUS* sp.
Chapada.

29. *CRICETUS* sp.
Sao Joao.

¹Report U. S. Geol. Survey Terrs. XI, p. 768.

30. *MUS ALEXANDRINUS* Geoffr.

Chapada. With a litter of young.

31. *MUS DECUMANUS* L.

Sao Joao.

ECHINOMYIDÆ.

32. *DACTYLOMYS AMBLYONYX* Wagner.

Three skins with skeletons, from Sao Joao.

These specimens agree with the descriptions given by Hensel and Burmeister. The dentition differs from that of the *D. typus* Geoff. as figured by Geoffroy¹ and F. Cuvier,† in having the two component V-shaped columns in both jaws united by a narrow isthmus, as is the case in the columns in *Echinomys*. This fusion is probably due to the age of the specimen, as it takes place on wearing in the genus *Echinomys*. Another character is the transverse lamina-like anterior plate of the first inferior molar (premolar), which is represented by a cylindric column in the *D. typus*, according to the authors cited. The superior molars are not nearly so close together anteriorly as is represented by St. Hilaire to be the case in the *D. typus*, and they diverge a little posteriorly.

HYSTRICIDÆ.

33. *SPHINGURUS PREHENSILIS* Linn.

Three skins with skeletons, and one skull, from Chapada.

34. *SPHINGURUS SERICEUS* sp. nov.

All the inferior surfaces with the forearm and lower leg destitute of spines, but clothed with a silky hair of which the basal half is black and the terminal half silvery white. Superior surfaces to the middle of the length of the tail, spinous; the spines concealed by long silky hair except on the head, nape, and proximal half of the tail. This hair is much longer than that on the inferior surfaces, and is similarly colored, i. e., with the basal half black, and the terminal half silvery, but more inclining to gray than on the inferior surfaces. The spines are an inch and a half long, becoming shorter on the tail, the front, and the upper lip, and are rather slender, and on the nape are decurved. Those on the interorbital and suborbital regions are still more slender. The nasal, preorbital, and subcaudal regions are

¹ Geoffroy St. Hilaire, *Nouv. Ann. du Museum I*, 450 pl. XVIII, fig. 3; *Is. Geoffr., Magaz. de Zoologie*, 1840, p. 27, pl. XXVIII, figs. 1-3. † *Dents des Mammifères*.

covered with rather stiff hairs, the latter becoming silky towards the end of the tail.

The spines are generally black on their basal half, and sulphur yellow on their terminal half, without other color on the apex. Those of the interorbital, suborbital and prescapular regions, are white, with a black space at the middle, and the base of the spines is also white below the black on the posterior regions of the body, and on the tail. The hairs covering the basal half of the tail below are yellow; those covering the terminal half are black. End of muzzle projecting beyond mouth, covered with minute silky hairs. Whiskers long, black.

Measurements of skin.

	M.
Total length.....	.665
Length from end of muzzle to vent.....	.395
" " " " orbit (on axis).....	.020
" of fore limb.....	.130
" " foot on sole (total).....	.045
" " claw (third).....	.020
" of hind limb.....	.135
" " foot on sole (total).....	.063
" of third hind claw.....	.018

Measurements of skull.

	M.
Total length on base.....	.073
Length to line of orbits (axial).....	.022
Interorbital width.....	.026
Length of palate from incisors.....	.032
Width of palate below m. iii.....	.010

In the determination of this species I have had before me in the museum of the Academy of Natural Sciences, three specimens of *S. villosus* Cuv. (*S. insidiosus* Licht.), and one each of the *F. melanurus* Natt., and the *S. nycthemerus* Licht. These render it evident that the only species with which it is necessary to compare the *S. sericeus* is the *S. affinis* of Brandt, which I have not seen. That animal is described as being brown above and below, instead of silvery white, and in having the spines brown tipped. The humeral spines are exposed, which they are not in the *S. sericeus*. It is said to have a postorbital process of the malar bone. This is wanting in the *S. sericeus* (two skulls).

The *S. sericeus* was probably included by Mr. Hensel in the

S. villosus in his memoir on the Mammalia of Southern Brazil.¹ He refers to such variations of color and length of hair, as will embrace both species. Should his species not be separable from the *S. villosus*, then the *S. melanurus* and *S. nycthemerus*, must be also united with the latter.

The entire absence of all brown color from the hair and spines of this species, and their replacement by silver white and sulphur yellow, gives it a very distinct appearance.

CAVIIDÆ

35. CÆLOGENYS PACA Linn.

One skin with skeleton from Sao Joao; one skin with skeleton from Chapada, and two skulls without locality.

36. DASYPROCTA AZARÆ Licht.

Six skins with skeletons from Chapada; one skin with skeleton from Sao Joao; four skins with skulls from Chapada; one skin from Chapada without skull; one do, from Sao Joao; two skeletons without skins from Chapada, and one from Sao Joao; and eight skulls without skins from Chapada; total twenty-five individuals.

The single skins from Sao Joao have the inferior surfaces of a deeper yellow than those from Chapada, and the hair of the rump is less tinged with gray and more with yellow, than in the latter.

37. DASYPROCTA AUREA sp. nov.

This species is represented by but a single perfect skin in excellent condition, from Chapada. It is superficially most nearly related to the *D. croconota* and *D. prymnolopha* of Wagler, and represents them in Southern Brazil. The species is of about the size of the *D. azaræ* and resembles it in general proportions. The unguis are, however, shorter, as is also the sole. In color it is peculiar. The hairs are uniform orange yellow on all parts of the body, paler at the base. There is no crest of long hair on the nape as in *D. prymnolopha*, but the hair of the rump is elongate, and rather paler in color than on other parts of the body. The top of the head is a little darker than the back, having a rufous tinge. The anterior faces of the feet are similar to the top of the head. The belly is a little paler than the back, but not so pale as the rump. Soles and claws yellowish horn color. The ears are rather sparsely haired. The tail is very short, as in the *D. azaræ*.

¹ Memoirs of the Akademie der Wissenschaften of Berlin, 1872, p. 56.

In the following measurements some allowance must be made for stretching of the skin.

Measurements of skin.

	M.
Total length.....	.660
Length of tail.....	.010
" from end of muzzle to orbit.....	.067
" " " " to ear.....	.113
" " " " to axilla.....	.273
" of fore leg.....	.142
" " foot below.....	.032
" of hind leg.....	.165
" " foot below.....	.103

This species seems to be nearer to the *D. croconota* than to the *D. prymnolopha*. Unfortunately I can find no skeleton or skull pertaining to the type, so that I can not describe their characters. It is much larger than the former species, exceeding it by more than six inches. Its uniform coloration is also entirely peculiar in the genus, for the hairs are not annulated. The feet are relatively much shorter than in the *D. croconota*; for according to Waterhouse, with a total length of 17 in. 9 lines, the feet of the latter measure (minus the nails) 3 in. 5 lines which is identical with the length of the foot in *D. aurea*, with a total of twenty-four inches. The head is the *D. croconota* measures 3 in. 11 lines. The relationships of the *D. rarea* appear to be with the *D. azarae*.

38. HYDROCHOÆRUS CAPYBARA Erxl.

Four skeletons, one with a skin and a separate skull, all from Sao Joao.

39. CAVIA APEREA Erxl.

Four skins, three with skeletons, from Sao Joao.

LEPORIDÆ.

40. LEPUS BRASILIENSIS Linn.

Two skins with skeletons; three skins with skulls; six separate skins, and four separate skulls; all from Chapada.

CARNIVORA.

CANIDÆ.

41. CANIS CANCRIVORUS Desmarest.

Three skins with skeletons; one skeleton without skin, and one skin without skeleton, all from Chapada.

42. *CANIS VETULUS* Lund.

One skin with skeleton, and one separate skull, from Chapada.

43. *CANIS ENTRERIANUS*, Burmeister, Reise durch die La Plata Staten 1865, II, p. 400.

Two skins with skeletons, and one skin with skull, all from Sao Joao, Rio Grande do Sul.

I am not as certain of the identification of this species as I would wish, and find it easier to determine what it is not than what it is. It differs from the preceding two species as follows :

C. cancrivorus ; Mandibular angle robust, truncate; posttympenic process adherent to bulla ; larger ; sectorial teeth relatively larger.

C. vetulus ; mandibular angle slender, acute; posttympenic process adherent to bulla; smaller; sectorial teeth relatively small.

C. entrerianus ; mandibular angle slender; acute; posttympenic process well posterior to bulla, but connected at base; larger; sectorial teeth relatively large.

This supposed *C. entrerianus* agrees closely in general characters with the *C. griseus*, Gray, described by Burmeister¹ excepting in the superior size. It agrees in dimensions with the *C. azarae* Cuv., but differs from both that species and the *C. magellanicus* Gray, in the possession of but one inferior premolar tooth with posterior cutting lobe instead of two. It also differs from both these species, and agrees with the *C. griseus* in the wide separation of the premaxillary and frontal bones. The general color is reddish, the hair on the anterior regions above, yellow near the tips, and brown at the tips, the brown becoming blackish on the posterior regions and the tail. Limbs light clean rufous; soles reddish brown. Belly and neck white, a gray band crossing just in front of the breast. Chin black except at tip, which is white. Upper surface of ears (which are large) bright rufous. The animal is at least as large as the red fox.

The coloration differs from that of *C. griseus* only in not showing the two white spots on the throat as described by Burmeister.

MUSTELIDÆ.

44. *GALICTIS VITTATA* Schreb.

Three skins with skeletons from Sao Joao.

¹ Erläuterungen zur Naturgeschichte Brasiliens, 1856, p. 48.

45. GALERA BARBARA Linn.

Five skins with skeletons from Chapada.

46. LUTRA PLATENSIS Burmeister.

A skin and skeleton from Sao Joao ; do. from Chapada ; do without locality.

A comparison of the skulls of this species with two of *Lutra canadensis* in my collection, and three in that of the Academy of Natural Sciences, show the following differences. The palate is not so much produced posterior to the molar teeth : the superior tubercular molar has smaller anteroposterior diameters, especially at the interior extremity ; and there is no preglenoid crest. The length of the skull is 103 mm., and the total length of the same individual is 1200 mm.

PROCYONIDÆ.

47. PROCYON CANCRIVORUS Cuvier.

Black-footed variety, Selater, Proceedings Zool. Soc., London, 1875, p. 421.

One skin with skeleton of a male, and a separate skull ; both from Sao Joao.

The skin is that of an adult male in excellent condition. The hair is dense and woolly on the body, but is very sparse on the anterosuperior faces of the feet. The tail is fusiform and bushy. The fundamental color is brownish-yellow above, but the hairs on the middle region of the back have long black extremities. The color below is light brownish yellow. The feet are all black up to the middle of the tibia and forearm. The tail is black, crossed by five annuli of yellowish brown.

For comparison with the skulls of this species I have eight of the *P. lotor* and two of the *P. hernandezii*. Of the former, one is from New York, and one from Pennsylvania ; of the latter, one is from S. W. New Mexico, and one from Western Oregon. The characters of the *P. cancrivorus* are easily observable ; while those of the two other species are also visible. I compare them in the following table :

I. Canines less compressed ; metaconid of P. m. I. often present.

Postdental part of palate wider than long ; malar bone weak ; front narrow, width equal diameter of orbit ; each nasal bone obliquely truncated ; larger.

P. cancrivorus.

Postdental part of palate as wide as long ; malar bone very robust ; front wide, flat, exceeding diameter of orbit ; each nasal bone truncate with produced outer angle.

P. hernandezii.

Postdental part of palate longer than wide ; malar bone robust ; front narrow, convex, width equal that of orbit ; each nasal bone deeply emarginate distally.....*P. lotor.*

II. Canines much compressed ; metaconid of P. m. I. always wanting.

Muzzle shorter ; palate angularly elevated posteriorly ; last inferior molar wider, heel median ; larger...*P. nasicus.*

Muzzle longer ; palate nearly flat posteriorly ; last inferior molar narrower, the heel internal ; smaller.....*P. nasua.*

In the two specimens of *Procyon cancrivorus* before me the metaconid of the p. m. 1. is well developed. In the *P. lotor* it is distinct in four out of eight skulls, and is represented by a mere trace in the other four. In a single *P. hernandezii* a trace only is visible. The form of the free extremity of the nasal bone is not constant in these species, and that of the last inferior molar will bear further examination.

The question is raised by Dr. P. L. Sclater, as above cited, as to whether the southern black-footed raccoon is specifically identical or distinct from the rufous-footed form from Surinam and Central America. In the lack of specimens of the latter region I cannot give a definite answer to this question.

In the skull of the *P. hernandezii*, above described, the *processus pyramidalis* of the palate has on its external face, a deep groove, bordered above and below by an alate crest, which are wanting in the *P. lotor*. The malar bone is also produced downwards at its inferior border next the maxillary, and the postorbital processes of the frontal and malar bones are both more distinct than in the *P. lotor*. Whether these are individual characters or not I cannot now determine.

48. *PROCYON NASUA* Linn. *Nasua rufa* Desm. Allen.

Three skins, with skeletons, all from Sao Joao.

49. *PROCYON RUFUS* Desmarest.

Twenty skins, three with skeletons, and one with a skull ; seventeen separate skulls and eleven skeletons, all from Chapada.

The skins of the Coatis from the two localities, differ constantly

and essentially, so that there appears to me to be two species, or, perhaps, subspecies. The most important difference is in the shape of the naked part of the nose. In the *P. nasua* from Sao Joao, in each of the three specimens, this region is not longer than wide above, and is wider than deep below, being separated by a broad band of hair from the lip border. In the *P. rufus* this region is constantly at least twice as long as wide above, and much deeper than wide below, with an angular outline which approaches near to the lip border. In the *P. nasua*, the white on the upper lips is wide and conspicuous, and the cheeks and top of head are of a light gray or pale brown. The top of the nose is light except at the end, and the median head stripe when present is of a darker color than the top of the head. In the *P. rufus* the white line on the upper lip is very narrow or wanting, and the head is generally blackish gray, the color of the vertex continued on the middle line to the black of the top of the nose. In the *P. nasua* the general color is light brown or gray; below light yellowish brown. Less than half the leg is black. In the *P. rufus* the back is dark rufous, the hairs generally shortly, sometimes deeply, black tipped: belly and throat bright rufus, except the white chin. More than half the legs black.

The colors of these specimens are as constant as the different character of the naked nasal surfaces, and the resulting appearance is that of two species. The specimens of the *P. nasua* appear larger and more robust than those of the *P. rufus*. I cannot detect any difference in the skulls and teeth; there being no osseous character corresponding to the different proportions of the external nasal organs in the two species.

I find the characters pointed out by J. A. Allen¹ to distinguish the two Brazilian species from the Mexican, to hold good.

CERCOLEPTIDAE

50. CERCOLEPTES CAUDIVOLVULUS Pallas.

A skull from Chapada.

FELIDÆ.

51. UNCIA ONCA Linn.

One skin with skeleton, and three skulls, from Chapada.

52. UNCIA CONCOLOR Linn.

One skull from Chapada.

¹ Bulletin of the U. S. Geolog. Survey of the Terrs, 1879, vol. v, p. 161.

53. *FELIS PARDALIS* Linn.

One skin from Chapada.

54. *FELIS GEOFFROYI* D'Orbigny.

One skin with skeleton from Chapada, and a skin with skeleton from Sao Joao.

55. *FELIS JAGUARONDI* Lacep.

One skin with skeleton from Chapada, and a skull from the same locality.

56. *FELIS BRACCATA* sp. nov.

Size of *F. jaguarondi*. Claws very small, white. Tail to end of vertebrae extending one inch beyond extended posterior limbs. Fur of irregular lengths, mingled everywhere with numerous long hairs. Color above brown, the hairs on the middle of the back, and on top of head and muzzle, with several black sections, which give a mixed black and brown hue to those regions. Upper portion of limbs of the same color, interrupted by black cross-bands, two on the fore leg and three on the hind, the former extending on the inner face as well. Distal half of all the legs black, without brown intermixture. Ears of moderate size with an apical angle a little less than right; the anterior half black, the posterior half gray. Inferior surface anteriorly furnished with long hairs of a buff color, which with short hairs of the same color near the anterior margin, show from above, giving a narrow brown border. Hair of the muzzle terminating in a straight transverse line which extends between the posterior parts of the nostrils. Lip whiskers long, buff with black bases. Some slender superciliary vibrissae. A buff spot below each nostril, and a similar one above the anterior part of each eye. Cheeks yellowish brown, hairs black-varied.

Chin very pale buff. This color deepens posteriorly, soon passing into the yellowish brown of the lower surfaces. Numerous white hairs are scattered on the thorax and abdomen, and numerous deep brown spots form transverse series, which sometimes become bands, mark the same regions. Three cross-rows of brown spots appear on the throat, the most anterior consisting of two small lateral, and a large median spot, crossing below the ears. The spots become more indistinct on the sides, and are wanting on the inferior surface of the tail. The latter is colored like the back above, and is black at the tip.

Measurements of the relaxed skin.

	M.
Length from end of muzzle to vent.....	.467
“ of tail from vent to end of vertebræ230
“ of ear above.....	.017
Width between bases of ears.....	.052
Length from anterior base of ear to end muzzle.....	.052
“ of fore leg.....	.195
“ of fourth anterior claw.....	.006
“ of hind limb (approximate).....	.195
“ “ from vent.....	.220
“ of second posterior claw.....	.005

This cat is evidently more nearly allied to the *F. jaguarondi* than to any other known species, and I need only point out the characters in which it appears to me to be distinct. The *F. jaguarondi* is evidently subject to considerable variation, but none of its forms approach sufficiently near to the *F. braccata* as to lead one to believe in the identity of the two. I have before me the skin of the *F. jaguarondi* above referred to from Chapada.

In what might be called structural differences I note the following. The feet of the *F. braccata* are smaller than those of the *F. jaguarondi*, and the toes are of more equal length. The claws are very much smaller. Both the internal and external toes are relatively considerably shorter on both limbs in the *F. jaguarondi* than in *F. braccata*. The fourth anterior and second posterior claws of the former species measure 6 and 5 mm. respectively; in the latter they measure 11 and 13 mm. respectively. The tail is rather shorter in the *F. braccata*, being less than the length of the body from the axilla to the vent, and only an inch in excess of the posterior legs extended posteriorly. The tail in the *F. jaguarondi* equals the body, and extends two inches beyond the limbs. This character may prove to be unimportant. Finally the ears in *F. jaguarondi* are broadly rounded; in *F. braccata* they are so prominently angular, as to present an apex rather less than a right angle. The fur of the muzzle has a truncate border, while in the *F. jaguarondi* the border presents an acute angle forwards, as it follows the superior outline of the nares above.

The differences in color are as follows:

The upper surfaces of the ears are like the top of the head in *F. jaguarondi*; in *F. braccata* they are of two colors in strong contrast, and both different from that of the head. In *F. jaguarondi* the in-

ferior surfaces are like the superior; in *F. braccata* they are totally different, resembling various spotted cats. The legs are colored on the upper surface like the back in *F. jaguarondi*, and are black below; in *F. braccata* they are cross banded proximately, and the distal halves are totally black.

The aggregate of characters indicates the specific difference of the *F. braccata* from the *F. jaguarondi*. The only approach to any of the peculiar characters of the *F. braccata* in descriptions of the *F. jaguarondi*, which I can find, is in that by Mr. Alston in the Fauna Centrali-Americana, who states that there are transverse bars on the *inside* of the legs.

It is to be much regretted that the label belonging to this specimen has been lost. I do not know therefore whether it was obtained in the province of Rio Grande do Sul, or in Matto Grosso.

DIPLARTHRA.

TAPIRIDÆ.

57. TAPIRUS AMERICANUS Briss.

One skin with skeleton from Chapada.

HIPPOPOTAMIDÆ.

58. DICOTYLES LABIATUS Cuv.

One skin with skeleton from Chapada; six skins from Chapada; one skin from Sao Joao; two skulls from Chapada.

One of the skins from Chapada presents certain peculiarities. It is not larger than the *D. tajassu*, and the bristles are longer and denser along the back, and especially on the rump, than in the other skins. The dirty white or yellowish part of the hairs is replaced by red-orange, giving the animal a fiery tint when the bristles are erected. It was labelled "red-pig" by Mr. Smith. Unfortunately its skull was not preserved. It does not appear to me to represent anything but a slight variety; perhaps it is a young male. In all the characters of the feet, muzzle, etc., it agrees with the *D. labiatus*.

59. DICOTYLES TAJASSU Linn.

Two skins with skulls from Chapada; two separate skins from do.; three skeletons from do.; thirteen skulls, do.; one skull from Sao Joao.

On comparing the sixteen skulls from Southern Brazil with five skulls in my collection, and one in the Museum of Princeton College, from Texas, I find such constant and important difference as to

satisfy me that the two forms cannot be regarded as specifically identical. Their differences may be compared as follows :

D. tajassu. Malar crest terminating above infraorbital foramen ; nasal bones rounded in cross-section ; first superior premolar (fourth of old works) tritubercular or rounded in outline, premolariform ; molars not wrinkled.

D. angulatus sp. nov. Malar crest continued forwards to base of canine alveolus ; nasal bones pinched or angulate on the middle line ; first superior premolar quadritubercular, with intermediate tubercles, and quadrate in outline, molariform ; molars wrinkled.

The characters cited are constant, although the amount of angulation of the nasal bones in the *D. angulatus* is subject to some variation. Another character, generally constant, is the form of the fossa above the diastema. In *D. tajassu* it is a narrow groove ; in *D. angulatus* it is a wide fossa. On comparing two Texan skins with five from Brazil, I notice but one distinctive character. The naked spot on the rump is very much larger on the former, and it is followed by a large patch of brown hairs, forming a distinct spot. In the *D. tajassu* the brown hairs exist, but in smaller numbers, and they are completely covered by the black hairs which are mixed with them. The feet have been cut off from my Texan skins, and those of other specimens are in skeleton, so that I cannot compare the hoofs. The Texan skulls average larger in dimensions than those from Southern Brazil.

The characters of the first premolar, and of the dentition generally, are well represented by Professor Baird, but the prolongation of the malar angle and the roof-shaped nasal bones are not very clearly expressed in the outline figures he has given.¹ His specimens came from the Rio Grande. Mine are, one from the Guadalupe R., two from the Llano R., and two from a tributary of the Red River.

The character of the first premolar in the *D. angulatus* approximates it to the *D. nasutus* Leidy.

CERVIDÆ.

60. CARIACUS CAMPESTRIS F. Cuv.

One skin with skeleton ; three skins, and three skulls ; all from Chapada.

¹ U. S. Mexican Boundary Survey, Pl. xxvii.

61. COASSUS RUFUS F. Cuv.

One skin with skeleton: one skin with skull; two skulls with skin of head, and six separate skulls, all from Chapada.

62. COASSUS SIMPLICICORNIS Illiger.

One skin with skeleton; one skin with skull; three skins and three skulls, all from Chapada.

QUADRUMANA.

CEBIDAE.

63. MYCETES SENICULUS Linn.

Very abundant at Sao Joao do Monte Negro. Varying in color from bright rusty red, to brownish black with dark rusty crown. No specimens from Chapada.

64. MYCETES BELZEBUL Linn.

Three specimens from Chapada Matto Grosso. The skull of this species does not differ from that of the last. The hair differs, especially on the head. It is procumbent and radiates in all directions from a point on the middle line posterior to the ears. It points directly forwards on the crown and front to the base of the nose, and anterior eyebrows, when it is met by hair directed upwards and backwards, forming a low tranverse elevation bordering the front, much as described by Slack in the *M. niger*. In the *M. seniculus*, the hair of the crown is erect and woolly from front to rear.

65. CEBUS CIRRHIFER. G. St. Hilaire.

One adult (female) from Sao Joao.

66. CEBUS ELEGANS G. St. Hilaire.

Abundant at Chapada. In the males there is generally a low sagittal crest, the glabella is swollen, and the frontal profile is convex. In the females there is no sagittal crest, the glabella is less swollen and the front is less convex. In the specimen above referred to, the *C. cirrhifer*, the characters of the skull are like those of the female *C. elegans*, but the front is flatter in profile.

SYNOPSIS.

The species obtained by the Naturalist expedition are distributed as follows, as to numbers and localities:

	Total.	Sao Joao.	Chapada.
Marsupialia.....	4	1	4
Chiroptera.....	9	3	6

Rodentia.....	17	9	10
Edentata....	9	3	9
Carnivora.....	16	6	12
Diplarthra.....	6	2	6
Quadrumana.....	4	2	2
	<hr/> 65	<hr/> 26	<hr/> 49

In the following lists the species of Sao Joao and Chapada are compared :

SAO JOAO.

CHAPADA.

MARSUPIALIA.

Didelphys marsupialis azarae.

“ auritus

Didelphys marsupialis azarae.

Philander pusillus.

Chironectes memina.

EDENTATA.

Myrmecophaga bivittata.

Myrmecophaga jubata.

64 *bivittata*

40 ? *sellata*.

Xenurus gymnurus.

Xenurus gymnurus.

16 *hispidus.*

Dasyus sexcinctus.

Priodontes maximus.

Tatusia peba.

Tatusia peba.

" *megalolepis*.

RODENTIA.

Sciurus astuans.

Sciurus variabilis.

Cricetus sp.

Cricetus sp.

Cricetus sp.

Cricetus sp.

Dactylomys amblyonyx.

Sphingurus prehensilis.

Sphingurus sericeus.

Calogenys paca.

Dasyprocta azarae.

Dasyprocta azarae.

“ *aurea*.

Hydrochærus capybara.

Lepus brasiliensis.

CHIROPTEA.

Phyllostoma hastatum.

Carollia brevicauda.

Artibeus planirostris.

“ *bilobatus*.

Wampyrops lineatus.

Sturnira lilium.

Desmodus rufus.
Nyctinomus brasiliensis.
Vesperugo arge.

CARNIVORA.

Canis entrerianus.
Gallictis vittata.
Lutra platensis.
Procyon cancrivorus.
 " *nasua.*

Canis cancrivorus.
 " *velut us.*
Galera barbara.
Lutra platensis.

Procyon rufus.
Cercoleptes caudivolvulus.
Uncia onca.
 " *concolor.*
Felis pardalis.
 " *geoffroyi.*
 " *jaguarondi.*
 " *braccata.*

Felis geoffroyi.

DIPLARTHRA.

Dicotyles labiatus.
 " *tajassu.*

Tapirus americanus.
Dicotyles labiatus.
 " *tajassu.*
Cariacus campestris.
Coassus rufus.
 " *simplicicornis.*

QUADRUMANA.

Cebus cirrhifer.
Myocetes seniculus.

Cebus elegans.
Myocetes belzebul.

From the preceding lists, it appears that but ten species were procured at both localities. Of the thirty-one genera obtained at Chapada sixteen were found at Sao Joao. Of the twenty-three genera found at Sao Joao, sixteen were obtained at Chapada. Of especial peculiarity of the Sao Joao collection may be mentioned the absence of the water opossum, the tayra, the six banded and giant armadillos, and of all the leaf-nosed bats. Also the absence of most of the cats, including the jaguar; also the absence of the deer. The Chapada collection lacks the crab-eating raccoon, and the gray coat; the capybara and the wild guinea-pig; and the bats of the families Emballonuridae and Vespertilionidae.

EDITORS' TABLE.

EDITORS: E. D. COPE AND J. S. KINGSLEY.

At the last meeting of the Society of Charities and Corrections the Rev. Oscar C. McCulloch, of Indianapolis, read a paper on the Tribe of Ishmael, in which he detailed the result of his studies on the pauper families of Indianapolis. The story he tells is a sad one. It is the history of generation after generation of paupers and criminals, of people sunk so low as not to have the slightest aspiration for a better life, who obey Scriptural injunctions only in that they are fruitful and multiply their vicious kind. Five generations of thirty families are traced, and of all the individuals whose records are worked out, but one ever emerged into a respectable life. This Tribe of Ishmael is but a repetition of the Jukes family, but it brings again to prominence a problem with which society has to deal. What shall be done to check the growth of these and similar parasites? They are sunk to a depth where no church can reach them; the so-called charity which gives to beggars and which patronizes the halt and maimed but encourages them in their present life; our present laws having no terrors for them, for imprisonment means but a winter of warmth, comfort and idleness. Were pauperism and beggary the only sins of these people then existence might be endured, but in the case of both the Jukes family and this tribe of Ishmael—and the same is true of all other similar families—every species of crime from murder down has been perpetrated by its members.

What can society do to protect itself against these pests? is a question which must be answered. Growth of cities means a disproportionate increase of this undesirable class. An answer seems difficult; in fact, we can only see one direction from which relief can come. The teaching of evolution must be recognized and incorporated in our laws. Evolution teaches that variation, the influence of environment, and adaptability to changed conditions are important factors in organic life, but it also teaches that these are fixed and perpetuated by heredity. It is this aspect of evolution that seems to point to the answer. The children of these people inherit scarcely a good trait, but are heirs to all that is vicious and criminal in their parents. They are begotten in criminality, nur-

tured in vice, and their maturity is crime. Our good people should refrain from indiscriminate alms giving, for this is offering a premium for a continuance of present conditions, and our laws should recognize the existence of heredity and make provision whereby the reproduction of this inherited vice could be checked. Such laws may seem harsh, but consider for a moment the saving to the country had the notorious Margaret, the mother of the Jukes family, been imprisoned so that none of her illegitimate children could have come into the world. Such a step would have been deemed cruel, but in the light of what we now know of the criminality of her descendants, society would have been justified in such extreme measures. The record of her children is but a continuous account of murder, highway robbery, burglary and prostitution, while the cost of prosecuting these criminals mounts up into the hundreds of thousands of dollars.

RECENT LITERATURE.

THOMAS' CATALOGUE OF MARSUPIALIA AND MONOTREMATA.¹—This publication is very timely, as it places in the hands of students the means of becoming acquainted with the characters of the species of the important orders named, at a time when it is important that they should have the knowledge. The Marsupialia are arranged in six families, of which three are referred to the Diprotodontia, and three to the Polyprotodontia. The species number as follows :

<i>Diprotodontia.</i>		<i>Polyprotodontia.</i>	
Macropodidae,	56	Peramelidae,	14
Phalangeridae,	34	Dasyuridae,	26
Phascologyidae,	3	Didelphidae,	24
Totals.	93	Totals.	64=157

The systematic treatment is conservative, and in the main satisfactory. Tarsipes seems, however, to deserve family recognition. In the matter of species the novel proposition is maintained that the larger South American opossums are only variations of the species with which we are familiar in this country. *Didelphys cancrivora*, *aurita*, *azaræ*, and *albiventris* become synonymous of *D. marsupialis* L. (= *D. virginiana* Kerr).

¹ Catalogue of the Marsupialia and Monotremata in the Collection of the British Museum. By Oldfield Thomas, 1888, pp. 401 ; xxviii plates.

We have fault to find with the lettering and other signs affixed to the paragraphs of the analytical keys of the various divisions. Were it not for the indenting and correct ranging of these paragraphs, their relations to each other could be only discovered by a considerable study of the signs affixed, and then many students, we suspect, would be hopelessly confused. The same system or *unsystem* has been adopted by Mr. Dobson in his catalogue of Chiroptera. It is to be sincerely hoped that in future the taxonomic keys may be arranged on the usual plan, such as for instance is employed by Mr. Boulenger in his catalogues of the Batrachia and Reptilia.

The twenty-eight plates are a welcome aid to the study, but the dental cusps are often poorly represented.

THE CLASSIFICATION OF THE CRINOIDEA appears now to have reached sound and rational basis as is clearly set forth in a recent important contribution¹ to Crinoid morphology by Messrs. Charles Wachmuth and Frank Springer. Although the subject is approached chiefly from a palæontological standpoint, morphological deductions derived from the latest researches among living crinoids have been duly considered. The systematic arrangement of the Crinoidea as indicated is of not less supreme interest to the palæontologist than to the biologist; and the classification as now proposed appears to be practically in agreement with the views of Dr. P. Herbert Carpenter, the distinguished English authority on recent crinoids. The necessity of a radical change in the existing classification centers around the discovery of the ventral structure in *Taxocrinus*. It is now clearly demonstrated that in this genus, and doubtless in the Ichthyocrinidæ generally, the mouth is open, and surrounded by five conspicuous oral plates, as in the recent genera *Rhizocrinus*, *Bathocrinus*, *Hyocrinus* and *Holopus*; thus differing in structure very materially from other palæozoic crinoids, which have the mouth closed. In the latter group, as is now conclusively shown, the orals are the hitherto denominated "central" and four "proximate" plates. The plan upon which modern crinoids are constructed is therefore one of high antiquity, dating back geologically to the Lower Silurian.

The Crinoidea are thus divisible into

1. Camarata.
2. Inadunata, comprising the branches Larviformia and Fistulata.
3. Articulata, including Ichthyocrinidæ and possibly *Uintacrinus* and *Thaumatocrinus*.
4. Canaliculata, including most of the mesozoic and recent crinoids.—*C. R. K.*

¹ Discovery of the ventral structure of *Taxocrinus* and *Haplocrinus*, and consequent modifications in the classification of the Crinoidea.—By Charles Wachmuth and Frank Springer. Proceedings of the Academy Natural Sciences, Philadelphia, Nov. 27, 1888.

FRITSCH AND KAFKA'S CRUSTACEA OF THE BOHEMIAN CRETACEOUS.*—This elaborate folio memoir of 54 pages is richly illustrated by ten plates printed in colors and 72 woodcuts, giving both views of the actual specimens and what appear to be excellent restorations of some of the more interesting forms.

Beginning with the cirripedia of the Bohemian chalk, remarks are made on the species, most of which have been previously described by the authors, but the new details and excellent figures add much to our previous knowledge. The same may be said of the Ostracoda which are illustrated by 20 figures in the text. The richest material consisted of the remains of Decapoda, especially the Macrura, and this is the most valuable and interesting portion of the work. Some of the new material in this order belongs to the Palinuridæ. Our knowledge of the extinct Mesozoic family Glyphæidæ, so well developed in Belgium by Winckler, is farther extended by the full accounts of the remains of *Glyphæa bohemica* Fr., the figures including a restoration. Of the family, Astacomorpha *Enoploclytia leachi* Mantell is fully restored, with dorsal and side views, and the text contains a very detailed description. The same may be said of *Schlüteria tetracheles* Fr., and of the species of Hoploparia, Paracletia, and Stenochelès. Further information of the Cretaceous specimens of Callianassa is given with a restoration, while new facts and figures concerning the Dromiacea, Oxystomata and other Brachyura complete the work, which as a whole is a most valuable contribution to our knowledge of extinct Crustacea.—P.

RECENT BOOKS AND PAMPHLETS.

American Society of Naturalists. Vol. I. Part Fifth.

Boettger, Oscar.—Aufzählung einiger neu erworbener Reptilien und Batrachier aus Ost-Asien. Beitrag zur Reptilfauna des obern Beni in Bolivia. Bericht Senckenberg Naturforsch. Gess. Frankfurt, 1887-'88. Both from the author.

Brinton, D. G.—Obituary notice of Philip H. Law, Esq. Read before the American Philological Society, Oct. 19, 1888. From the author.

Goode, G. Brown.—The Beginning of American Science in the Third Century. From the author.

Buller, Walter L.—Catalogue of the Collection of New Zealand Birds in the Manor House. Letcombe Regis, Wantage. Petherick and Company, London.

*Die Crustaceen der Böhmischen Kreide formation. Von Dr. Ant. Fritsch und Jos. Kafka. Prag., 1887.

- Clark, Wm. B.*—Discovery of Fossil-bearing Cretaceous Strata in Anne Arundel and Prince George Counties, Maryland. Reprint from Johns Hopkins University Circulars. No. 69. From the author.
- Cooke, W. W.*—Report of Bird Migration in the Mississippi Valley in the years 1884 and 1885. Edited and revised by Dr. C. Hart Merriam. From U. S. Agricultural Dept.
- Dawson, George M.*—Glaciation of British Columbia. Extract from Geological Magazine, Aug. 1888. From the author.
- Dawson, William J.*—Specimens of *Eozoon canadense* and their Geological and other Relations. From the author.
- Dollo, L.*—*Achenosaurus multidentis*. Extrait du Bulletin de la Société Belge de Géologie, Tome II., 1888. From the author.
- Dollo, Louis.*—Sur la Signification du "Trochanter Pendant" des Dinosauriens. Extrait du Bulletin Scientifique de la France et de la Belgique.
- Doua, G.*—Note Erpetologique. From the author.
- Dugés A.*—Description of *Storeria dekayi*, var *anomala*. Extract from Proceedings of U.S. Nat. Museum, 1888. From the author.
- Ganong, W. F.*—The Echinodermata of New Brunswick. Extract from Bulletin of New Brunswick Natural History Society. From the author.
- Gilbert, G. K.*—Changes of Level of the Great Lakes. Reprint from the Forum. Vol. V., 1888. From the author.
- Gould, George M.*—Is the Electric Light Injurious to the Eyes. Reprint from the Medical News, Dec., 1888.
- The Psychological Influence of Errors of Refraction and of their Correction. Reprint from the Medical and Surgical Reporter, Sept., 1888. From the author.
- The Homing Instinct. Reprint from Progress, Oct., 1888. From the author.
- Henshall, James A.*—Contributions to the Ichthyology of Ohio. —Some Peculiarities of the Ova of Fishes. Reprints from the Journal Cin. Society Natural History, 1888. Both from the author.
- Hicks, Lewis E.*—Irrigation in Nebraska. Extract from Bulletin of Nebraska Agricultural Station. Vol. I. From the author.
- James, Joseph F.*—The Ivorydale Well in Mill Creek Valley. An Ancient Channel of the Ohio River at Cincinnati. Reprints from the Journal of the Cin. Society Natural History, 1888.
- Jordan, David Starr.*—Manual of the Vertebrates. Revised and enlarged. From the publisher.

- Keyes, Charles R.*—On the Forms of the Lower Coal-Measures of Central Iowa.—Descriptions of Two New Fossils from the Devonian of Iowa. Reprint from the Proceedings of the Phila. Academy of Natural Sciences. From the author.
- Lord, William R.*—Homing of Dogs. From the author.
- Langley, S. P.*—Energy and Vision. Reprint from American Journal of Science. Vol. XXXVI., Nov., 1888. From the author.
- Lydekker, R.*—Catalogue of Fossil Reptilia, &c. Extract from the Geological Magazine, Oct., 1888. From the author.
- Macoun, John.*—Catalogue of Canadian Plants, Part IV.—Endogens. From the Geol. and Nat. Hist. Survey of Canada.
- Le Marquis de Saporta.*—Origine Paléontologique des Arbres cultivées ou utilisés par l'homme. From the author.
- Mitchell, Henry.*—On the Circulation of the Sea through the New York Harbor. From U. S. Coast and Geodetic Survey.
- Müller, Max F.*—Science of Thought. From the publishers.
- Newberry J. S.*—The Coals of Colorado. Ext. from the School of Mines Quarterly, Vol. IX, No. 4, July, 1888. From the author.
- Orr, Henry.*—A Contribution to the Embryology of the Lizard. Reprint from the Journal of Morphology, Vol. I., No. 2, Dec., 1887. From the author.
- Bulletin No. 2, Bulletin No. 3.*—Ohio Agricultural Experiment Station.
- Osborn, Henry Fairfield.*—Additional Observations upon the Structure and Classification of Mammalia. Ext. from Proceedings of Phila. Academy Nat. Science, Oct., 1888. From the author.
- Packard, A. S.*—Aspects of the Body in Vertebrates and Arthropods. Reprint from Am. Nat., Sept., 1884. From the author.
- Penna. State College Agricultural Station, Bulletin No. 3, Bulletin No. 4.
- Pennsylvania Geological Survey, Atlas Bucks and Montgomery Counties.—Atlas Eastern Middle Anthracite Field, Part II.—Atlas Western Middle Anthracite Field, Part II.—Atlas Northern Anthracite Field, Part II.—Atlas Annual Report, 1886, Part III.—Annual Report, 1886, Part IV. and Atlas. From the Survey.
- Pennsylvania State College Agricultural Station. Bulletin No. 5, October, 1888.
- Report of the Pennsylvania State College for the year, 1887. Part II.
- Report of Trustees of Peabody Museum of Am. Archæology and Ethnology, V. IV, No. 1.

Poulton, Edward B.—The True Teeth and the Horny Plates of *Ornithorhynchus*. Reprint from the Quarterly Journal of Microscopical Science. From the author.

Preliminary List of the Lower Crustacea of Staten Island. From the Proceedings of the Natural Science Association of Staten Island.

Read, M. C.—Archæology of Ohio. From the author.

Renard, A.—Recherches sur la Composition et la Structure des Phyllades Ardennais. Extrait du Bulletin du Musée Royal d'Histoire Naturelle de Belgique. Tome III. From the author.

Riley, Charles V.—Report of the Entomologist for the year 1887. (with illustrations). From the author.

Seeley, H. G.—On the Dinosaurs of the Maastricht Beds.—On a Sacrum of a Bird from the Wealden of Brook. Reprints from the Quarterly Journal of the Geological Society, May, 1887. On the Nature and Limits of Reptilian Characters in Mammalian Teeth—Researches on the Structure, Organization, and Classification of the Fossil Reptilia—On the Classification of Fossil Animals commonly named Dinosauria—On the bone in Crocodilia which is commonly regarded as the Os Pubis, and its representative among the Extinct Reptilia—On *Pariesaurus bombidens* (Owen), and the significance of its affinities to Amphibians, Reptiles, and Mammals. Reprint from Proceedings of the Royal Society. Vol. 42, 43, 44. From the author.

Chapman, Henry C.—Observations on the Female Generative Apparatus of *Hyæna crocuta*. Ext. Proceedings, Phila. Academy of Natural Science. June, 1888. From the author.

Slade, D. D.—On certain Vacuities or deficiencies in the Crania of Mammals. Bulletin of Harvard Museum of Comparative Zoology, Vol XIII., No. 8. From the author.

Smiley, Charles W.—Altruism Considered Economically. From the author.

Smock, John C.—Building Stone in the State of New York. Bulletin of the New York State Museum of Natural History. No. 3. March, 1888. From the author.

Taylor, Edgar W.—Geology in our Preparatory Schools. Reprint from the American Geologist, May, 1888. From the author.

Tyndall, John—Diamagnetism and Magneto-crystallic Action. Appleton and Company, New York.

Tyrrell, J. B.—Report on Portions of Northern Alberta, Assiniboia and Saskatchewan. Part E., Annual Report 1886, Canadian Geol. Survey.

- Tuckerman, Frederick*—Supplimentary Note on *Tænia saginata*. From the author.
- Vaillant, Léon M.*—Note Complémentaire sur l'anatomie de *l'Anai des lugubris* Hallowell.—Remarques sur le genre *Ripistes* de Dujardin. Extraits du Bulletin de la Société Philomatique de Paris, 1885—1886.
- Vanfleet, W.*—Some Native Birds for Little Folks. From the publishers.
- Von Klein, Carl H.*—Address on Rhinology. Reprint from the Journal of the American Medical Association. From the author
- Ward, Lester F.*—Our Better Halves. Reprint from The Forum, Vol. VI. From the author.
- Civil Service Reform. Reprint from The Historical American, July, 1888, Vol. I. No. I.—What Shall the Public Schools Teach? Reprint from The Forum. Both from the author.
- Weithofer K. Ant.*—Einige Bemerkungen über *Carpus der Proboscidiæ*. From the author.
- Woodward, A. Smith.*—A Comparison of the Cretaceous Fish-fauna of Mount Lebanon with that of the English Chalk. Ext. from the Annals and Magazine of Natural History. On the Genus *Synechodus*.—Note on the Occurrence of a Species of *Onychodus* in the Lower Old Red Sandstone Passage Beds of Sudbury, Herefordshire. Extracts from the Geological Magazine. From the author.

GENERAL NOTES.

GEOGRAPHY AND TRAVEL¹

AFRICA, THE WESTERN SAHARA.—As Spain has recently annexed the African coast between Morocco and Cape Blanco, with an indefinite extension inland, the geography and ethnography of these regions is naturally prominent in Spanish geographical papers. Sres. Coello, Cervera, Quiroga, and Costa have recently explored this region, especially that part known as the Adrar Temar which is a raised oasis or meseta containing an area equal to a sixth of that of Spain. The mesa terminates in a point towards the south and is crossed here and there by ranges of hills, which have a slighter slope in its

¹ Edited by W. N. Lockington, Philadelphia, Pa.

eastern than in its western portion. In the centre opens the principal valley, that of Atar, which runs from north-west to south-east, and is the most thickly-populated part of the oasis. The greatest height of these hills is not more than 125 metres and most are much lower. The shifting sand-dunes which surround the whole of the oasis have penetrated between the two principal ranges of hills until they reach the walls of the towns of Uadan and Xingueti. The hills of Adar contain pines (*P. maritimus*) and several other kinds of trees, with spiny shrubs and herbage which grows even among the sand. Gazelles and other antelopes, foxes, hares, porcupines, etc., are among the wild animals. The natives have herds of oxen and buffaloes and flocks of sheep and goats; they cultivate wheat, barley, millet, sorgum, maize, cucumbers, etc., and tobacco; but have no olives, figs, or oranges. Their principal article of food is the date. Everywhere in the Sahara there is water beneath the surface, often at a slight depth. The oasis is salubrious; and the temperature varies from 4 to 40 degrees, centigrade. The inhabitants of Adrar are Berbers, and some preserve the type tolerably pure, though as a whole they are mixed with Arab and Negro. They are divided into four castes, sacerdotal, warrior, plebeian, and slaves; the noble or warrior class being the owners of the soil. The civil and religious head of this people is a hereditary sovereign, but the real power in each tribe is in the hands of an assembly of notables. A hundred slaves form the bodyguard of the king, who resides in Atar. Most of the natives belong to the mussulman sect of the Dylani, whose religious head or Great Makkaddem resides at Uadan.

Xingueti, the most populous town of the oasis, contains from 3 to 4,000 souls; Atar 2,000 to 2,500; Uyeft about 1,500, while Uadan, which in the XVI. century was the capital, has greatly decayed. There is another Adrar, the Adrar Sutuf, about which less is known. The district next the coast and between the two Adrars is known as Tiris, and its inhabitants are shepherds and guides of caravans. In this country there are some curious rocks that are wider at the top than at the bottom, looking like basaltic monuments. At some points the basalt is formed into great arcades like those of an aqueduct. The districts called Skarna and Semmur form the drainage area of the Seguia-el-Hamra, which may be called a river though it has no perennial flow. Yet the Seguia is never entirely dry and there must be springs at certain points; it has many affluents, and the whole basin is humid and very productive. The indolent inhabitants are more given to the chase than to cultivation.

The most powerful tribes are those of the Erguibat, who reside in the upper part of the river. This tribe sends caravans in all directions, some having as many as a thousand camels guarded by two to three hundred armed men. The small commercial town of Tenduf belongs to the tribes of the Tadyacant.

THE OASIS OF FIGUIG.—France has intended to annex the oasis of Figuig, which is situated near Algeria, south of the mountains of Maiz and Beni-Smir. This territory is in Morocco and pays a small tribute to the Sultan, but is practically independent. The people are freebooters and their excursions have given the French government the pretext for claiming damages against the Sultan of Morocco. The last governor of Figuig was a fanatic Musselman and stirred up against the infidel rulers of Algeria all the Arabs under his jurisdiction. Three employes of the Algerian government were taken prisoners, and the French, after occupying with their forces the railroad from Saida to Ain Sefra, have procured the dismissal of the governor of Figuig.

GEOGRAPHICAL NEWS.—The Philippine Islands, although probably the most valuable of Spain's remaining possessions, and although their productions are exceedingly rich and varied, have not hitherto attracted emigrants from the mother country. It is now proposed to choose for colonization the Island of Paragua, not more than a thousandth part of which is at present occupied by settlers, the remainder being the exclusive property of the State. The forest riches of Paragua are immense, the species including some that are not known in the rest of the archipelago. Among these is *Fragosa peregrina*.

Without the province of Algeria or the protectorate of Tunis, the French "colonies" or possessions, scattered over the four quarters of the world, contain an area of more than two millions of square kilometres, and a population of rather more than twenty-two millions, without including that of the Congo and Gaboon territory. The colony of Senegal contains about 805,000 square kilometres and that north of the Congo at least 600,000.

GEOLOGY AND PALÆONTOLOGY.

THE VERTEBRATE FAUNA OF THE EQUUS BEDS.—While the Equus Beds are found at various localities in North America, the greater number of characteristic species of Vertebrata have been obtained in three regions. First, the Oregon Desert; second the Country of the Nueces, S. W. Texas; third the Valley of Mexico. I give lists of the species found at these and their localities.

Recent species are indicated by a *

1. The species found in the Oregon Desert are the following:

MAMMALIA.

Holomeniscus vitakerianus Cope.

" *hesternus* Leidy.

Eschatus longirostris Cope.

" *condens* Cope.

Equus major Dekay.

" *occidentalis* Leidy.

" *excelsus* Leidy.

Elephas primigenius Blum.

Canis latrans Say*.

Lutra piscinaria Leidy.

Castor fiber L.*

Arvicola sp.

*Thomomys talpoides** Licht.

" *?clusius** Coues.

Myodon sodalis Cope.

AVES.

Podiceps occidentalis Lawr.

" *californicus*.*

Podilymbus podiceps.*

Graculus macropus Cope.

Anser hypsibatus Cope.

" *canadensis* L.*

" *albifrons gambeli*.*

" near *nigricans* Lawr.*

Cygnus paloregonus Cope.

Fulica americana.*

And numerous other species.

PISCES.

Leucus altarcus. Cope.

Myoleucus gibbarcus Cope.

Cliola angustarca Cope.

Catostomus labiatus Ayres.*

" *batrachops* Cope.

II. From S. W. Texas we have the following species.¹

Equus barcenæi Cope.

" *fraternus* Leidy.

" *excelsus* Leidy.

" *occidentalis* Leidy.

" *crenicens* Cope.

Elephas primigenius Blum.

Canis sp.

Glyptodon petaliferus Cope.

Cistudo marnochii Cope.

III. From the Valley of Mexico the following have been recorded.²

¹ See American Naturalist, 1885, p. 1208.

² Proceeds. Amer. Philos. Society, 1884, p. 1.

Bos latifrons Harl.
Eschatus conidens Cope.
Holomeniscus sp. minor.
 " *hesternus* Leidy.
 " sp? *californicus* Leidy.
Platygonus ? *compressus* Lec.
Equus barcenaci Cope.
 " *excelsus* Leidy.
 " *tau* Owen.
 " *crenident* Cope.
Elephas primigenius Blum.
Dibelodon shepardi Leidy.
Canis sp.
Ursus sp.
Glyptodon ? *petaliferus* Cope.
Myiodon sp.

IV. The following species were derived from a locality in Whitman Co., Tacoma (or Washington).

Myiodon sp.
*Taxidea americana** (*T. sulcata* Cope.)
Equus sp.
Holomeniscus sp.
Holomeniscus sp.

ALCES BREVITRABALIS, sp. nov.

This deer is represented by the basal part of the antler of three large and one small specimens. They agree with those of the genus *Alces* in the absence of a brow-antler, and the flattening of the beam preparatory to a palmation. The palmate part of the horn is lost from all the specimens. It was probably not nearly so extensive as in *Alces machilis* since its base is not wider than that of the bezantler. The beam is short, and becomes rapidly much compressed in a plane transverse to the axis of the skull (judging by the obliquity of the base), which is also the plane in which the equally compressed bezantler is given off, in the external direction. The surface is not very rough, nor are the tubercles of which the burr consists, very large. A few nutritious grooves are well-marked. The external edge of the beam becomes truncated towards the base, and the section of the latter is a spherical triangle, transversely placed, with the external apex more or less obtuse.

Measurements of No. 1.

	M.
Diameters at base of beam { anteroposterior.....	.043
{ transverse.....	.058
Length to base of bezantler.....	.100
No. 2.	
Long diameter of bezantler at base.....	.045

In No. 2 a tuberosity on the external face of the beam a short distance above the base, represents the brow-antler.

As compared with the year-old moose of which a figure is given by Prof. Baird (Rept. U. S. Pacific R. R. Exped. IX, p. 632), these horns differ in the relatively shorter and more compressed beam, with the less expansion of the portion immediately distad to the bezantler.

The specimens of this species are all from Whitman County, Tacoma (Washington), and were obtained by Dr. J. L. Wortman.

ALCES SEMIPALMATUS sp. nov.

This species of elk is known to me from a basal portion of a horn of a larger individual, and the corresponding part of a smaller one. The larger specimen is considerably smaller than the adult of the *A. brevitrabalis*, representing a species of about the size of the black-tailed deer (*C. macrotis*), while the latter is as large as the *Cervus canadensis*. It differs from the *A. brevitrabalis* in the relatively and absolutely longer beam, and the relatively greater expansion at the base of the bezantler. The general characters are otherwise much as in that species. The beam is compressed, with the external face truncate, and the bezantler directed outwards in the plane of the beam. The burr is very prominent, consisting of a rim of confluent tubercles. The beam is smooth on the sides, but has several tubercles on the external border. Unfortunately the beam is so split that its transverse diameter can be only surmised, from the curves of its surface.

Measurements.

	M.
Diameters at base of beam { anteroposterior.....	.015 to .020
{ transverse.....	.030 to .035
Length of beam to base of bezantler.....	.120
Long diameter of bezantler at base035

Besides the greater length of the beam, its expansion near the base of the bezantler and away from it, is greater than in the larger species above described, and the concavity of the surface is wider.

From Whitman Co., Tacoma, Dr. G. M. Sternberg, U. S. A.

CARIACUS ENSIFER, sp. nov.

This deer is represented by the beams of the horns of two individuals of probably different ages. In one of them a considerable part of the beam is preserved, so that a good idea of its characters may be obtained. It differs from both of the other species described in the presence of a short brow-antler, which originates exactly at the base of the beam, and is directed horizontally. It is depressed and not very long, and is accompanied by a twin process at its base, with which it is united by a horizontal lamina or palmation. The beam is, like that of the species already described, compressed, with a flattening of one edge, that immediately above the brow-antler. A similar flattening characterizes the base of the external edge,

which is not wider than the internal base, the reverse of what is seen in the *Alces brevitrabalis*. The beam soon becomes compressed, especially on the antero-external edge (above the brow-antler), and in the specimen where it is best preserved, it is quite acute. In neither specimen is there any indication of a bezantler. The longer specimen may be possibly young, but its surface is strongly keeled and furrowed. The burr consists of acute edges connecting sharp points. The other specimen is smoother and rather more robust. It shows no indication of the expansion of the species referred to *Alces*, which it would do were it proportioned as in the *A. brevitrabalis*.

Measurements. No. 1.

	M.
Diameters at base of beam { anteroposterior.022
{ transverse.035
Estimated length of brow-antler above.040
Diameters beam .090 M. from burr { anteroposterior.007
{ transverse.025

From Whitman Co., Tacoma, Mr. C. H. Sternberg.

This species is referred to *Cariacus*, although the position and direction of the brow-antler are different from those of any known species of the genera. I suppose it to be one of the *Telemetarcapi* solely from its resemblance to the *Alces* here described.

Several species have been found in localities not far removed from those mentioned, and in beds possibly of the same geological age. As it is not yet possible to determine with accuracy the ages of these fossils, I only refer to them. Such are an *Aphelops* from the valley of Toluca, Mexico; and *Mastodon americanus* and *M. serridens* from S. W. Texas.

The close parallelism between the faunæ at the three localities is seen in the probable and ascertained identity of several species in the lists of each. The following species have been found in the two regions most remote from each other, the valley of Mexico and the Oregon Desert.

Eschatus conidens Cope.

Holomeniscus hesternus Leidy.

Equus excelsus Leidy.

Elephas primigenius Blum.

Of these, the *Equus excelsus*, and *Elephas primigenius* have been found in S. W. Texas. These species, with the *Equus barcenai*, *E. crenidens*, and probably the *Glyptodon petaliferus* are common to the last named locality and the valley of Mexico.

The horizon to which these beds should be referred was held by King to be the Upper Pliocene. I have coincided with this opinion on palæontologic grounds, since the fauna presents a much greater diversity from that now inhabiting North America than that of the Plistocene beds of Europe exhibit when compared with the existing

Vertebrata of that country and Asia. Four families have disappeared since that epoch, viz.: The Glyptodontidæ, Megatheriidæ, Elephantidæ and Eschatiidæ. The genus *Holomeniscus* has passed away. The disproportion of extinct forms increases as we go south. Thus in the Oregon beds we find that out of twenty-six determined species, ten are still living. With further examination this list will be probably increased. At the Texan and Mexican localities no recent species have been yet determined. As we enter the South American extension of the same fauna, the number of extinct species and genera greatly increases, although some recent species have been found associated with them in the Pampean Fauna.

I have found Indian implements in considerable numbers in such close proximity to the fossils of the Oregon Desert, as to lead to the strong suspicion that they are contemporary with the latter. This opinion has been, according to Mr. G. K. Gilbert, reduced to certainty by the finding of such implements in place in the *Equus* beds in Nevada or California. The age of the *Equus* beds is placed by Mr. Gilbert as Pliocene (Quaternary.)

THE NEIGHBORHOOD OF SEVILLE.—The city of Seville is situated in the alluvial plain of the Guadalquivir, which every few years, at the height of the winter rains, rises sufficiently high to flood the streets. On both sides of these alluvial flats is a pliocene area, rising into the clayey hills; this is succeeded by a belt of miocene. To the southeast of the river, between it and the sea, are secondary rocks, among which the Nummulitic and Jurassic have been recognized. Between the folds of these rocks are intercalated series of more or less metamorphosed rocks, which were regarded by Sr. Macpherson as Triassic, but which Sr. Calderon, from the discovery of fossils still remaining in them, has proved to be altered Nummulitic or Jurassic strata, according to their position. On the opposite side of the river there exists a Triassic area, but the greater part of the formations are either Palæozoic or eruptive. Granites, gneiss, syenite, diorite, diabase, and porphyry cover extensive areas, there are patches of Carboniferous strata, and a considerable extent of Cambrian.

At Peñaflar, a few miles above Seville, the mountains (Sierra Morena) come near to the river, and in the hollows are deposits of gold-bearing clay, which is supposed to be derived from the diorite and diabase above, though it is mingled with material from the archaic limestone and mica-schists. A section at this spot shows the limestone interrupted by two broad bands of diorite, also with lines of phosphorites, a thin vein of magnetic iron, and two bands of mica-schists. Near the Guadalquivir there is a great fault, which brings the Miocene suddenly to the surface. The upper portion of the Miocene is conglomerate, the lower molasse. Two wide bands of amphibolite intersect the Miocene. On the south of the Guadal-

quiver a second fault, affecting only the Miocene, occurs.—*H. V. Lockington.*

AN ATTEMPT TO COMPUTE GEOLOGICAL EPOCHS.—The precession of equinoxes and the periodical change on the eccentricity of the terrestrial orbit are reflected on the geological series of strata, and are the key to the calculation of the duration of epochs.

The precession causes the winter and summer to be alternately longer and shorter. In the semiperiod when winter is longer than summer, the distinction between inland and coast climate becomes more prominent. The currents of the atmosphere become stronger, and in consequence of that, the ocean currents increase in strength, and that again reacts upon the climate. The periodical change of the climate produced by the precession is not great, but it is sufficient to imprint itself in the alternation of beds, and in the formation of beach-lines, terraces, series of moraines, etc. To each period of precession corresponds one alternation of strata.

The eccentricity of the Earth's orbit is periodically changeable.

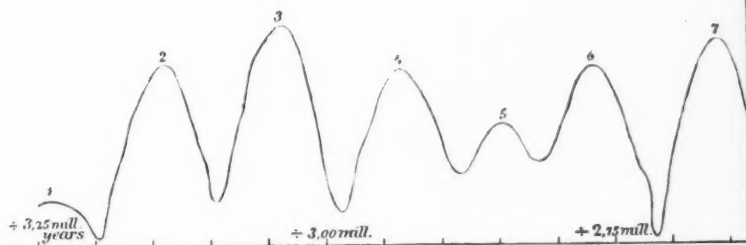
Its mean value rises and falls for a period of about $1\frac{1}{2}$ millions of years, with 16 oscillations. Such a rise and fall I term a cycle, and each cycle is, in the calculated curve, composed of 16 arcs.

The tidal wave, which is the most powerful agent in altering the sidereal day and in lengthening it, rises and falls in some measure with the eccentricity. It so exceeds the other forces that act in altering the length of the day, that the day steadily becomes lengthened, on the average, more quickly in the middle of the cycles, when the mean value of the eccentricity is greatest, and more slowly at the limit between them, when the eccentricity is the least; and in respect of the respective arcs with increasing speed during falling eccentricity.

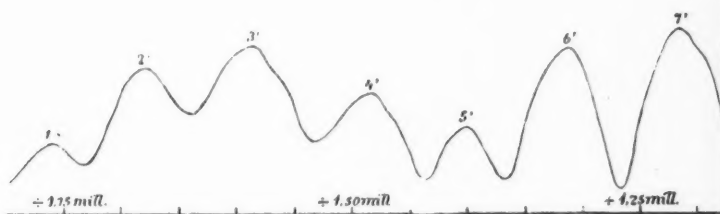
The interior of the globe is plastic, owing to great pressure. The surface or "crust" opposes the greatest resistance to change of form. But according as the sidereal day becomes lengthened, and the equatorial regions of the earth increase in weight; a steadily increasing strain acts outward towards higher latitudes, and the strain increases until the resistance is overcome. We must also bear in mind that forces too slight to produce a sudden change in a solid body, may still produce a change of form when they act through long periods. Therefore the lengthening of the sidereal day acts not only on the seas, but also on the form of the solid globe. The earth approaches steadily more and more to the spheriform, but the solid crust is more sluggish in its movement than the seas, which immediately accommodate themselves to the altered time of rotation. As the motive force of these movements of seas and solid earth is periodically changeable, according to the eccentricity of the earth's orbit; these movements take place also, periodically quicker and slower. And as the seas always accommodate themselves to the forces before the dry land does, it is likely that the

Eccent
calculated according to Stockwell's formula by

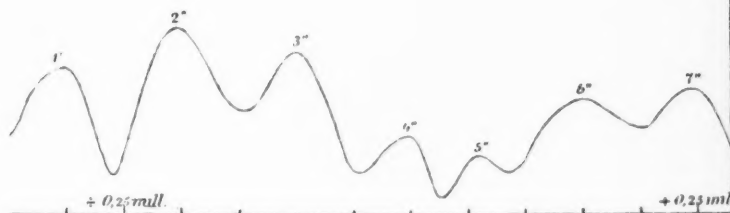
Cycle I.



Cycle II.



Cycle III.



*Eccentricity of the earth's orbit,
Stockwell's formula by R.W.Mc.Farland (Amer.Journ.of*

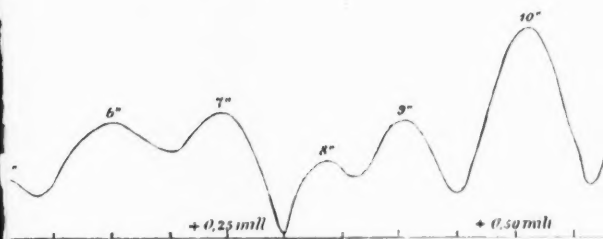
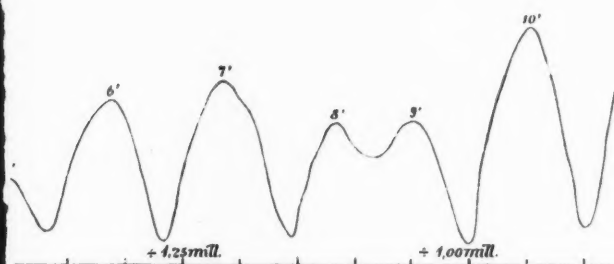
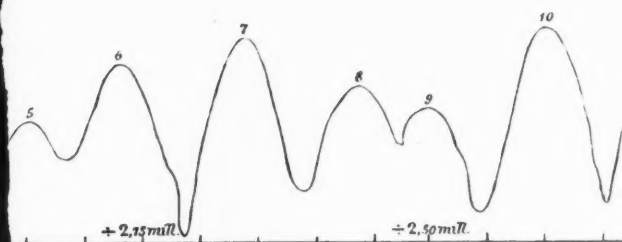
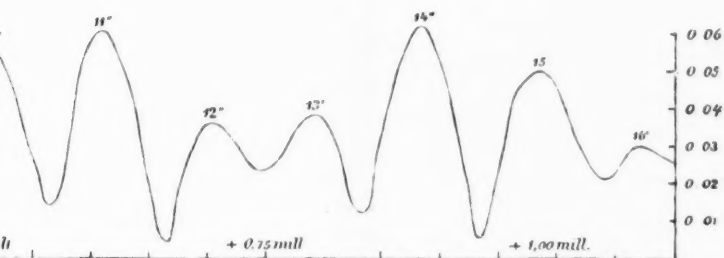
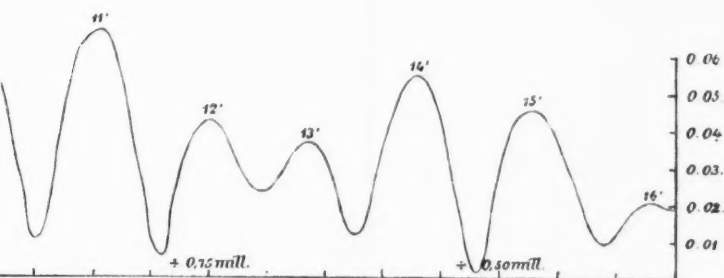
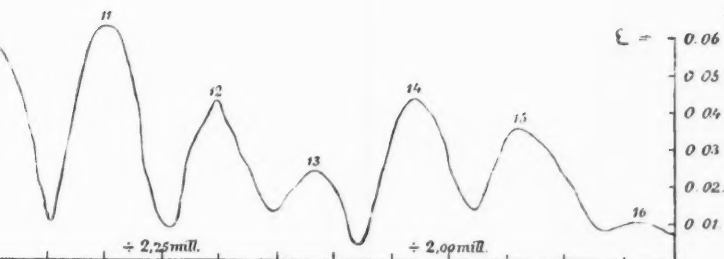


PLATE II.

bit,
Journal of Science, ser. 3 vol. 20. New Haven 1880).





beach-lines come to oscillate up and down once, for each rise and fall of the eccentricity of the earth's orbit. That is the case in respect of both the respective arcs of the curve and of the cycles. On such a cycle "the mean level of the sea" rises and falls once in 16 oscillations.

The sidereal day has (cfr. Damine) become several hours longer. It is therefore probable that there must have accumulated such a strain in the mass of earth, that a slight increase of strain would be sufficient to cause changes of form at the weakest points. It is also likely that those partial changes in the solid mass of the earth must occur, especially at times of great eccentricity, or some time after such an occurrence, when the motive force increases quickest.

The change in the tidal-wave, caused by the variation of the eccentricity, is presumed to be sufficiently great to explain the displacement of the beach-lines. A few metres of vertical displacement of the beach-line is sufficient to produce in the deep basins, an alteration of many metres of thick marine and fresh water beds. And as regards the changes in the solid body of the Earth, we must recollect that the series of beds is not complete at any single spot. In other words the oscillations were not general to such an extent that they were contemporaneous everywhere. Only by partial changes of form sometimes here, sometimes there, always at the weakest point in each age, has the solid earth approached to the spheriform. To each arc of the curve there corresponds, therefore, only a partial and not a general change in the form of the solid earth. And the oscillation of the beach-line, corresponding to the arc, can, therefore, not be pointed out everywhere, but only in the basins when the forces at that time exerted their effect. In this way we can obtain a perfect profile only by combining layers of all the Tertiary basins. Neither were the changes of the solid earth everywhere equal in extent, but were greatest at the weakest points of its surface, so that quite extensive local upheavals may be caused by slight changes in the length of the sidereal day.

That is the case as regards the individual oscillations, but even the great transgressions of the sea, of which one occurs in each cycle, need not be owing to any great rise of the sea level; as great flat lands may be covered and drained by a relatively small vertical displacement of the beach-line. But these great changes in the distribution of land and sea were undoubtedly sufficiently great to produce considerable changes of climate. Extensive seas in higher latitudes cause their climate to be mild, and vice versa.

If we now compare, keeping these principles in view, the curve of the eccentricity with the geological series of beds, we find an agreement indicating that the hypotheses are correct. The two cycles of the calculated curve, correspond to two geological cycles. Each of the cycles has 16 arcs that correspond to 16 slight oscillations of the beach-lines or 16 geological stages. In each of these stages there are as many alternations of strata as there are preces-

sions in the corresponding arc, and the mean sea level rises with the mean eccentricity in the middle of the cycles, and falls at the limit between them, and hand in hand with the mean sea level, rises and falls also, the temperature in the higher latitudes.

The doctrine here discussed agrees with Lyell's great principle. Slow changes in the length of the winter and summer and in the force of the tidal-wave, produce periodical changes of climate, and displacements of the beach-lines. The earth changes its form slowly and imperceptibly. The changes take place so slowly that the effects, first after expiration of many thousands of years, begin to appear distinctly. There are two astronomical periods which are the causes of the great and radical changes, of which geology leaves to us testimonies from remote ages, and which will still continue in the future, for millions of years to produce similar changes in the geography of the globe, its climate and its animal and vegetable life.—*A. Blytt in Christinia Videnkabs Selskabs Forhandlingar, 1889, No. 1.*

THE WESTERN SAHARA.—According to the data brought together by Sr. C. G. Toni, in the *L'Esplorazione Commerciale*, from the explorations of Spanish and German travelers, the western coast of Africa consists of a Cretaceous mass which is continued from the Cretaceous nucleus of Morocco and terminates at Cape Blanco. In immediate contact with the Cretaceous band of the coast and immediately above it, exists a thick deposit of desert sands, which covers all the subjacent formations. Beneath this sand through a large portion of its extent, rocks of the Devonian period are believed to extend and crop out in a few points. The hills of the oasis of Adrar Temar contain trachyte and have some peaks of granite and basalt. These hills also contain quartz, marble and various siliceous and ferruginous rocks.

In the "Neues Jahrbuch für Mineralogie, Geologie und Paläontologie, Jahrgang, 1888, I Band; drittes Heft," Dr. Ferd. Roemer describes and figures a new genus of Echinodermata from Texas, to which he gives the name of "Macraster," and calls the only species *Macraster texanus*. This fossil has long been familiar to the writer in his stratigraphic investigations in Texas, and it makes a well defined horizon near the very top of the immense thickness of lower marine Cretaceous in Texas, and does not occur, as Dr. Roemer infers from the specimens which accompanied it to Germany, with the *Exogyra texana* fauna, a statement which has been verified by Mr. Geo. Stolly, the collector. This fact is important because of the tendency upon the part of European palæontologists to underestimate the value of the stratigraphic differentiation of the Texas Cretaceous.—*R. T. Hill.*

CENOZOIC.—Teeth of *Elephas antiquus* found at Rinconada, Cantillana and other places in the province of Seville Spain, to-

gether with vertebræ of the same species, are to be found in the museum at the University at the last named place, which museum also contains the mandibles of *Elephas armeniacus* found at Almadovar del Rio near Cordoba.

GEOLOGICAL NEWS.—GENERAL.—Herr Schlüter in two papers entitled "Ueber die regulären Echinodermata der Kreide Nord Americas," and "Ueber Inoceramus und Cephalopoden der Texanischen Kreide, (Niederrhein. Gessellschaft at Bonn, March, 1887), describes *Salenia mexicana*, from Chihuahua, Mexico, and *Inoceramus subquadratus*, *Turrillites irrideus*, and *T. varians* from Austin, Texas. The validity of the three species last mentioned is exceedingly doubtful, as the descriptions give no data sufficient to differentiate them from species already described by Roemer and Shumard. He also asserts that the Austin Cretaceous is equivalent to that of Ems, Germany, a rather indefinite statement since within the corporate limits of Austin is found nearly the whole range of the comprehensive Texas Cretaceous under conditions which could hardly be duplicated.—*R. T. Hill.*

MINERALOGY AND PETROGRAPHY.¹

PETROGRAPHICAL NEWS.—Messrs. Adams and Lawson² of the Canadian Geological Survey have been examining the rocks associated with the apatite in the Canadian apatite mines, to determine whether or not there is present a rock similar to the scapolite-diorite occurring in the Norwegian apatite region. They find that in some instances the Canadian apatite veins occur in a rock, composed essentially of orthoclase and biotite, with or without augite, i.e., either mica-syenite or augite-mica-syenite. None of the thin sections of the rocks associated with the apatite resemble in the least those of the Norwegian rock. At other regions in the Canadian Laurentian, however, associated with limestones and amphibolites, specimens were collected which are found to bear a strong likeness to the scapolite-rock from Norway. A specimen from near Arnprior on the River Ottawa, is described as a granular aggregate of augite, hornblende, scapolite, epidote, enstatite, pyrrhotite and rutile. The hornblende appears in some cases to be primary and in others to be secondary. The scapolite is in large colorless grains, many of which show poly-synthetic twinning lamellæ, which may be due to the remains of the

¹ Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

² Can. Rec. of Science, 1888, p. 185.

original plagioclase from which the scapolite was derived. Inclusions of dust and fluid cavities are present in the scapolite in large quantities and microlites are developed along its cleavage planes. The rutile occurs in grains closely associated with the scapolite. In several instances these grains appear to be made up of lamellæ, in which, however, there is no alternation of extinction as in the case of polysynthetic twins. The authors call the rock a scapolite-diorite. A rock from McDougall, Parry Sound District, contains a basic plagioclase in addition to the minerals mentioned above, and has been called plagioclase-scapolite-diorite. Schistose rocks with the composition of the last mentioned diorite, have had their schistosity produced in them by pressure, as is evident from the shattered condition of the plagioclase constituent. The scapolite in these rocks bear no marks of a secondary origin from plagioclase. Augite is lacking, but biotite and quartz are observed in addition to the minerals found in the diorites.—The dolerites¹ of Londerf, Hesse, embrace coarse and fine grained varieties as well as glassy phases. The former consists of plagioclase, a titaniferous augite, olivine, a little enstatite, magnetites, apatite and titanite. The olivine is a pure hyalosiderite, elongated in the direction of the *c* axis, and intergrown with plates of titanite in such a way that these are perpendicular both to the cleavage planes and to the long axes of the olivine crystals. Amygdaloidal cavities contain the rock forming minerals together with little crystals of hornblende, and tridymite and masses of hyalite. To account for the existence here of well developed crystals of the minerals occurring in the body of the rock, Streng supposes the bubble of gas which gave rise to the cavity to have moved along through the partly solidified magma, shoving out of its way the liquid portions and leaving the crystals free. Other substances are supposed to be due to the alteration of the glass which was left attached to the crystals. The hornblende is regarded as having been deposited from the hot solutions, which would naturally circulate through the amygdaloidal cavities. The sublimation theory proposed to explain the existence of druse minerals in cavities of eruptive rocks he dismisses as unsubstantiated by facts. Upon the surface of the glassy dolerite is a crust of altered material with the characters of palagonite.—Lœwinson-Lessing² has embraced in a very readable article the views which are gradually becoming prevalent among petrographers in reference to the origin of diabases, gabbros and diorites. After briefly calling attention to the acknowledged differences between the structure of intrusive and effusive rocks, and emphasizing the peculiar features of the diabase structure, the author declares that this is the structure of an effusive rock rather than of an intrusive one. The association of diabases with fossil-bearing tuffs and their gradation into augite-porphyrites leads him to regard them as effusive under water, with the augite-porphyr-

¹ Streng : Neues Jahrb. f. Min., etc. 1888. II. p. 181.

² Bull. Soc. Belg. d. Géol. II. 1888, p. 82.

rites as their equivalent terrestrial effusives. The gabbros he acknowledges to be intrusive, and would regard as the intrusive equivalents of the diabases. In recapitulating his views the author divides the diabasic rocks into (1) intrusives (gabbros, granitoid-diabases), and (2) effusives, (a) terrestrial (augite-porphyrates and melaphyres), and (b) sub-marine (ophite-diabases). The diorites he would separate into those which are merely altered phases of diabase (including the epidiorites and the proterobases), and the primary diorites, which owe their hornblendic constituents to the presence of water vapor in the magma from which they solidified. Since hornblende is found only in those portions of rocks which cooled in the intratelluric period, *i. e.*, under such pressure as would prevent the escape of water, the diorites are to be looked upon as characteristic plutonic rocks.—The kersantite¹ dyke rocks from south-western East Thuringia contain numerous inclusions of granite which have been more or less affected by the enclosing rock. The quartz of the granite has been enlarged by the addition of new material, and has yielded tridymite as a product of its alteration. It contains numerous glass inclusions as the result of the fusion of original mica inclusions. Mica, augite and a new crystallization of feldspar have originated from the feldspar of the granitic rock. The original mica has changed into spinel and augite. Garnet, sillimanite, rutile, and apatite, which were among the original constituents of the granite can no longer be detected in the inclusion. The ground-mass in which the new minerals lie consists of a micro-felsitic aggregate of quartz and feldspar, in which are numerous concentric and radial spherulites, and a well-marked fluidal structure. Inclusions of a mica schist, and of a cordierite bearing andalusite contact rock are also found in the same kersantite.—Mr. Cross² communicates some brief descriptions of a few of the eruptive rocks occurring in Custer Co., Colorado. The first rock described is a garnetiferous rhyolite with a eutaxitic structure. It is remarkable for its simple composition which is as follows:

SiO₂ Al₂O₃ Fe₂O₃ FeO MnO CaO MgO K₂O Na₂O H₂O P₂O₅
 75.20 12.96 .37 .27 .03 .29 .12 8.38 2.02 .58 tr.=100.22.

A sanidine-oligoclase-trachyte possesses the peculiarity of a secondary porous structure due probably to the alteration of inclusions. Its biotite has yielded augite on its corroded edges. In a syenite occurring in narrow dykes are irregularly-shaped pieces of biotite, with their greatest development in the direction of their *c* axes. Peridotite and an olivine-augite-diorite are also described. The former contains brown hornblende and hypersthene in about equal proportions.—The same writer³ announces the discovery of a second occurrence of phonolite in the United States. The specimen examin-

¹ R. Pohlmann: Neues Jahrb. f. Min., etc. 1888, II. p. 87.

² Proc. Col. Scient. Soc. 1887, p. 228.

³ Proc. Col. Scient. Soc. 1887, p. 167.

ed was not found in place. It was picked up on the Eastern slope of the Hayden divide, between Florissant and Manitou, Colorado. The rock consists of about 25 per cent. of nepheline, of granular sanidine, prismatic particles of a deep green hornblende, and little colorless grains of a mineral supposed to be augite.—After an examination of the specimen of altered diabase from Quinnesec, Mich., Cathrein¹ concludes that the rutile, which Williams² thought to be secondary after ilmenite contains no titanium, and can, therefore, not have given rise to the rutile by alteration.—A porphyritic hornblende—andesite from Dewéboyun in Turkey in Asia, is described by Löwinson-Lessing³ as composed by large crystals of hornblende and labradorite in a groundmass consisting of plagioclase microlites in a glassy base.—Karl Schneider⁴ has observed the alteration of spheue into calcite and perofskite in a phonolite from Bohemia.

MINERALOGICAL NEWS.—*New Minerals*, *Sperryllite*⁵ is the first compound of platinum that has been found as a mineral. It occurs in the Vermillion mine, in Algoma, Ontario, in a layer of loose material on the contact between a vein of gold-bearing quartz and the enclosing rock, and in pockets in the decomposed ore. In both cases it is associated with copper and iron pyrites. The sperryllite is found in small lustrous grains, which are fragments of crystals on which Mr. Penfield has discovered cubic, dodecahedral, octahedral, and pyritoid faces. The color of the fragments is tin-white and their powder black. Their hardness is between 6 and 7. Although their specific gravity is 10.602 the grains have a tendency to float upon the surface of water. Analysis yielded :

As	Sb	Pt	Rh	Pd	Fe	SnO ₂
40.98	0.50	52.57	.72	tr.	.07	4.62

corresponding to Pt As₂, after allowing for the cassiterite present as an impurity. The artificial compound made by passing vapor of arsenic over red hot platinum possesses many of the properties of the natural substance, the most characteristic of which is instant fusion upon contact with red hot platinum, with the evolution of almost odorless fumes of arsenic, and the production of porous excrecences of the color of platinum. The composition of the mineral and its crystallization relegate it to the pyrite group.—Attention has already been called to the new mineral⁶ Beryllonite. A full description of its occurrence and properties has recently been given by Messrs E. S. Dana and Wells.⁷ The mineral is found at the

¹ Neues Jahrb. f. Min., etc. 1888. II. p. 151.

² Amer. Naturalist, Feb. 1888, p. 168.

³ Bull. Soc. Belg. d. Géol. 1887. I. p. 110.

⁴ Neues Jahrb. f. Min., 1889, I. p. 99.

⁵ Amer. Jour. Sci., Jan. 1889, p. 71.

⁶ Amer. Naturalist, Nov. 1888, p. 1023.

⁷ Amer. Jour. Sci., Jan., 1889, p. 23.

base of the McKean mountain near Stoneham, Maine, in the destitute of what is supposed to be a granitic vein in mica schist. In addition to the facts announced in the former notice it may be added that the mineral is orthorhombic with $a : b : c = .5724 : 1 : .5490$. It has four cleavages parallel respectively to $0P$, $\infty P\overline{\infty}$, ∞P_3 and $\infty P\overline{\infty}$ in the order of their perfection. Twins parallel to ∞P are not rare. It is colorless or yellow and transparent. The plane of its optical axes is $\infty P\overline{\infty}$. Its double refraction in negative and $2H\alpha = 72^\circ 47'$ for yellow light. The mineral is remarkable for the presence in it of cavities elongated parallel to the c axis. These sometimes contain two movable bubbles, and are so numerous as to produce an apparent columnar structure in the mineral.—*Dahlite* from Bamle, Norway, is described by Brögger and Bäckström¹ as a new mineral occurring as a thin yellow crust on massive apatite. This crust is composed of little fibres arranged perpendicular to its surface, which is smooth and lustrous. The mineral is translucent, is optically negative, has a hardness of about 5 and a specific gravity of 3.053. It is a hydrous double phosphate and carbonate of calcium ($4Ca_3(PO_4)_2 + 2CaCO_3 + H_2O$) It gave on analysis :

P_2O_5	CO_2	CaO	FeO	Na_2O	K_2O	H_2O
38.44	6.29	53.00	.79	.89	.11	1.37

*Awaruite*² is the first nickel-iron compound described that is not of meteoric origin. It occurs in small plates and granules in the sand of George River, in the western part of South Island, New Zealand. Its composition is :

Ni	Co	Fe	S	Si
67.63	.70	31.02	.22	.43

The mother rock of the mineral is a serpentine that has originated from an olivine rock by alteration.—Darapsky³ adds *Naposite* to the list of iron sulphates from Atacama, Chili. It is found in radially fibrous, glistening, brittle, dark-red crystals containing 24.72 percent. of SO_3 , 30 per cent. of Fe_2O_3 , and 16.43 per cent. of H_2O , thus corresponding to the formula $Fe(FeO_3 SG 43, + 10 H_2O)$ It is decomposed by water and by acids.—*Mazapilite*. Dr. König⁴ announces the discovery of a new arsenide of calcium and iron from Zacatecas, Mexico. It occurs in dark red and black, probably orthorhombic crystals, with a hardness of 7 and a specific gravity of 3.567.

MISCELLANEOUS.—Gonnard⁴ describes natural corrosion figures in *Barite* from the Puy-de-Dôme, that consist of little depressions

¹ Aefv. Vet.—Akad. Förhandl, 1888, d. 493. Ref. Am. Jour. Sci. Jan. '89, p. 77.

² Vom Rath: Ref. Neues Jahrb. f. Min., etc., 1889, I. p. 23.

³ Boletín d. l. Soc. Nac. Min., Santiago de Chile, Ref. Neues Jahrb. f. Min., 1889, I p. 33.

⁴ Bull. Soc. Fr. d. Min., 1888, XI., p. 269.

with an orthorhombic or a monoclinic symmetry. Those of the latter kind are triangular in shape and are supposed to owe their abnormal symmetry to twinning.—Mr. Cross¹ has noticed striations in the cubic faces of *galena* from the Minnie Moore mine, Bellevue, Idaho, which he believes to be due to twinning lamellæ produced by the slipping of alternate bands of the mineral along gliding planes, as a consequence of pressure. The twinning planes lie in the zone between $\infty O \infty$ and ∞O —New methods for the detection of tin, caesium, and rubidium under the microscope are suggested by Streng². The detection of tin depends upon the fact that KCe and Sn Ce yield a double salt, which crystallizes in little tabular orthorhombic crystals, which upon the addition of nitric acid pass over into octahedra modified by icositetrahedrons. Caesium and rubidium chlorides with stannous chloride in hydrochloric acid solutions give crystals of the same shape as those of potassium and stannous chlorides, but in the case of caesium these are brightly polarizing, while in the case of rubidium they are monoclinic. The author also calls attention to the fact that all hydrofluoric acid sold as pure, even when carefully made from cryolite, contains silica and cannot be used for the detection of this substance in small quantities.—Calcium carbonate readily decomposes solutions of aluminium salts in the cold, with precipitation of gelatinous aluminium hydroxide, which, in the presence of coloring matters absorbs these and becomes stained. Under the same conditions dolomite produces no change in the solutions unless it remains in contact with them for a long time. A knowledge of these facts induces Lemberg³ to propose a method of distinguishing between calcite and dolomite in thin sections of rocks. The solution which he proposes for use is made by dissolving four parts of dry aluminium chloride in sixty parts of water and adding to it six parts of *haematoxylin campechianum*,

BOTANY.⁴

TWO BIG-ROOTED PLANTS OF THE PLAINS.—Now and then some of the plants of the plains present odd characteristics not observed in some of the eastern regions. Two species native of the open plains at an altitude of from 2,000 feet above the sea to the base of the Rocky Mountains are remarkable for their enormous roots. One

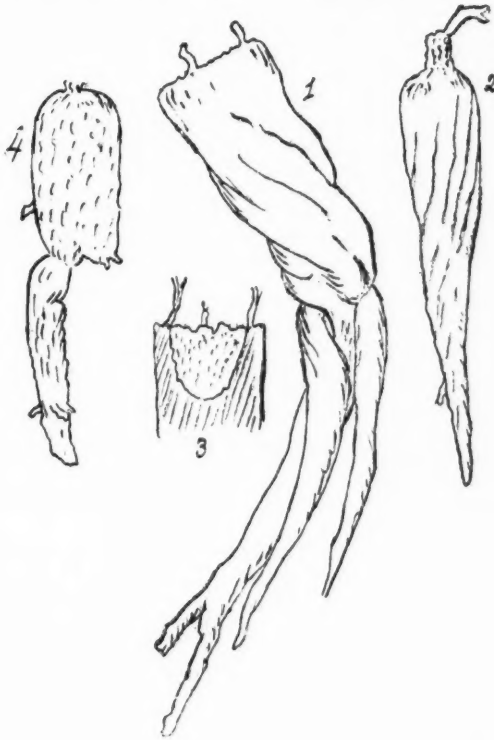
¹ Proc. Col. Scient. Soc. 1887, p. 171.

² Neues Jahrb. f. Min., etc., 1888, II., p. 142.

³ Zeits. d. deuts. geol. Gesell. XL., 1888, p. 357.

⁴ Edited by Chas. E. Bessey, Lincoln, Nebraska.

of these is the Wild Pumpkin (*Cucurbitale perennis* Gray), which produces a trailing stem, bearing triangular, woolly pubescent leaves, whose blades are six to eight inches in length. The fruits are about the size of an orange, and are perfectly spherical in shape. When ripe they are yellow with some greenish longitudinal markings. Internally they are exceedingly fibrous, and contain a great number of seeds (about 200) which are about one-third of an inch in length



But the root is the remarkable part of the plant. Two specimens were brought to my laboratory last fall, figures of which are given herewith. The largest (Fig. 1) measured when first dug nearly seven feet in length, and at the top or crown had a diameter of fully eleven inches. The crown is curiously hollowed out, as shown in Fig. 3, the cavity being fully six inches in depth. The inside of the cavity

is covered with a healthy cortex, and there is no sign of decay about it. Around the margin of the cavity are the remains of several stems, showing that in this portion the buds for the annual running stems occur. At about two feet from the crown the root bends abruptly and sends out a couple of branches. When in the ground the part below the bend was vertical, while that above was inclined. The root grew upon a hillside and its upper portion was nearly if not quite perpendicular to the surface of the ground. The bend was probably occasioned by the slow sliding of the upper strata of the soil down the hill. The branches are much smaller where they emerge from the main root, and enlarge considerably within the first six or eight inches.

The smaller root (Fig. 2) measured when taken from the ground nearly four feet in length, and had a diameter of about eight inches. It is regular in form, and is not much branched. Its crown is extended into a neck five or six inches long, and upon the upper part of this are the remains of the branching stems.

Both roots are very fibrous internally, almost woody in fact, but they contain also an enormous amount of stored up nourishment for the rapid development of the annual stems. The first (1) weighed eighty pounds when fresh, and the second (2) thirty-three. But this store of nourishment is amply protected against the hungry gophers, moles, mice, rabbits, squirrels and larger animals, for it is intensely bitter. In the struggle for existence those only have remained whose bitterness was sufficient to overcome the hunger and thirst of the animals of the plains.

The second big-rooted plant is the Wild Morning Glory (*Ipomœa leptophylla* Torr), a beautiful plant of a bushy habit, bearing numerous large pink-purple flowers closely resembling those of the common cultivated Morning Glory of the gardens. The stems are numerous and branching, but not twining, and they rarely attain a height of more than a couple of feet.

The root is enormous, often approaching the size of that of the Wild Pumpkin. A specimen in my laboratory is shown in Fig. 4. It is nearly three feet in length, and evidently was originally much larger, and has a diameter of eight inches. As may be seen, it branches at about fifteen or sixteen inches from the top. On the one side there were originally several branches, but on the other but one. This shows, also, the peculiarity noticed above of the smaller size of the branch root at the point of its origin, and its subsequent enlargement.

Both of these plants come down upon the plains to about the 100th meridian. In northern Nebraska at Long Pine, I have seen the Wild Morning Glory ten or twelve miles east of that meridian. The wild pumpkins are abundant in Lincoln County (south of the Platte River), not more than fifteen or eighteen miles west of the line mentioned.—Charles E. Bessey.

HERBARIUM NOTES.—AN ALPHABETICAL ARRANGEMENT.—In arranging an herbarium one's first thought would be to arrange it according to some recognized natural system of which it would then constitute a practical application. Yet, as herbaria are intended much more for use in the identification of species than for instruction in systematic botany or for embodiment of ephemeral classifications, alphabetical arrangements based on assumed convenience are probably the prevailing ones. These alphabetical arrangements may be either of species in a genus or of genera in certain large groups, as the Fungi, the composite or the Grasses; but they are all based on the idea of convenience of reference.

As to the alphabetical arrangement of genera. Without considering the question whether a natural arrangement, even if slightly less convenient, would not be preferable, I believe that such an arrangement can be shown to be equally convenient. In the first place the largest families of Fungi, for example, as the Icaceæ, Uredineæ, or Sphæriaceæ; are by no means as large as A, C, S, or P of an alphabetical arrangement. The larger groups like S and P are exceedingly inconvenient unless subdivided; and surely it is of more value to the student to know the subdivisions of the Sphæriaceæ than of S, unless he is preparing himself to be a Register of Deeds. The convenience of an alphabetical arrangement arises from the familiarity of the alphabet, yet the names of the natural subdivisions of plants should be scarcely less familiar to the botanist. Then, too, allied genera are often wanted at the same time; genera of the same initial letter probably never. Plants are generally studied in small groups; and nothing could be more inconvenient to the student of a tribe than to find six genera in six distinct groups, each of which must be carefully searched, nor more convenient than to have them together, perhaps even placed in the very order in which he wishes to study them.

Somewhat more can be said in favor of an alphabetical arrangement of species in a genus. Such an arrangement is not needed to any appreciable extent, however, except in very large genera. Yet in such genera as *Carex*, for example, a natural arrangement is equally convenient, without regarding the fact that it is infinitely more instructive. Almost any one who has spent much time in the matter can put a *Carex* into the proper group, the species within the group is the difficulty; and it is much more convenient to have all the species of a group together than to be forced to search through five or six letters. But in genera of Fungi, as *Cercospora*, where there is no very good natural arrangement, it might be said, is better than one based on the host, such as is usually given in the books, because neither is particularly instructive and the first is the handier. Yet, as herbarium specimens are consulted for the most part in connection with a manual, an arrangement following it would certainly be perfectly convenient. And, perhaps, it would not trouble the student over much to remember that *Cercospora viticola* is on the

grape and therefore, goes in the section "in *Di cotyledonis lignosis*," while he could gain very little from the reflection that its specific name begins with "J."

THE ALGÆ FUNGI AND LICHENS.—Many who no longer hold the idea of the autonomy of the groups Fungi, Algæ, and Lichens, nevertheless persist in keeping them separate in the herbarium. This, too, is done on the plea of convenience, as they are usually studied by different students. Letting alone the question of whether it would not be better for the mycologist to think more about Algæ, I believe that an herbarium where all plants are arranged according to a natural system without regard to anything else is perfectly convenient for reference, as long as the families are clearly indicated on the cases. If this is so, the natural arrangement is clearly preferable. For these are not mere questions of convenience. In the case of a classification, if mere convenience of placing specimens in their proper genera and species were all that was to be considered, perhaps no system would be superior to the celebrated one of Linnæus. But this is one of the last things which we demand of a classification. The function of a classification is to teach us the relations, the ancestry and thus a part, it may be, of the history of plants. So with an herbarium. Its object should be no more to furnish authentic specimens for the determination of single species than the higher one of teaching us the relations of these species by bringing together their names.—*Roscoe Pound*.

SACCARDO'S GREAT WORK ON FUNGI.—Although Saccardo's *Sylloge Fungorum* has been noticed in the *NATURALIST* from time to time upon the appearance of the volumes, it may be of service to our readers to indicate more fully the scope of the great work. The intention of the author (Professor P. A. Saccardo of the University of Padua) is to publish in one work the descriptions of all the Fungi now known in all parts of the world. Such an undertaking involves as all will admit, an immense amount of labor, and he must have been a bold man indeed who willingly entered upon it. As a matter of course such a work, intended for the whole world, could be written in Latin only.

The first volume appeared in 1882, the second in 1883, the third in 1884, the fourth in 1886. In the latter year A. N. Berlese and P. Volgins brought out a supplementary volume to volumes I to IV, in which additions and corrections were made. The fifth volume appeared in 1887, and the sixth and seventh in 1888. The eighth and concluding volume may be looked for some time during the present year. The total number of pages thus far printed is 6898, and doubtless the final volume will bring the number up to 7700.

The system adopted by Saccardo may be learned from the following synopsis:

ORDER PYRENOMYCETÆ Fr. Em. De Nat.

Family 1. *Perisporiaceæ* Fr.

- " 2. *Sphaeriaceæ* Fr.
- " 3. *Hypocreaceæ* De Nat.
- " 4. *Dothideaceæ* Nits. et Fkl.
- " 5. *Microthyriaceæ* Sacc.
- " 6. *Lophiostomaceæ* Sacc.
- " 7. *Hysteriaceæ* Corda.

ORDER SPHEROPSIDÆ Lev. reform.

Family 1. *Spheroideæ* Sacc.

- " 2. *Nectroideæ* Sacc.
- " 3. *Leptostromaceæ* Sacc.
- " 4. *Excipulaceæ* Sacc.

ORDER MELANCONIÆ Berk.

Including six "Sections" which are designated Hyalosporæ, Scalocæ-allantosporeæ, Phæosporæ, Didymosporæ, Phragmosporæ

ORDER HYPHOMYCETÆ Martins.

Family 1. *Mucedineæ* Link emend.

- " 2. *Dematiæ* Fr.
- " 3. *Stilbæ* Fr.
- " 4. *Tuberculariæ* Ehrenb. emend.

ORDER HYMENOMYCETÆ Fr.

Family 1. *Agaricineæ* Fr.

- " 2. *Polyporeæ* Fr.
- " 3. *Hydnæ* Fr.
- " 4. *Theleporeæ* Pers.
- " 5. *Clavariæ* Corda.
- " 6. *Tremellinæ* Fr.

ORDER GASTEROMYCETÆ Wild.

Family 1. *Phalloideæ* Fr.

- " 2. *Nidulariaceæ* Fr.
- " 3. *Lycoperdaceæ* Ehreub.
- " 4. *Hymenogastraceæ* Vtt.

ORDER PHYCOMYCETÆ DeBary.

Family 1. *Mucoraceæ* DeBary.

- " 2. *Peronosporaceæ* DeBary.
- " 3. *Saprolegniaceæ* DeBary.
- " 4. *Entomophthoraceæ* Fowakow.
- " 5. *Chytridiaceæ* D. By eb. Worou.
- " 6. *Protomycetaceæ* DeBary.

COHORT MYXOMYCETÆ Wallr.

Subcohort I. **Myxomyceteæ** (Grauina)

ORDER PROTODERMIALLE Rost.

Family 1. *Protodermiaceæ* Rost.

ORDER CALCAREÆ Rost.

Family 1. *Cienkowskiaceæ* Rost.

- " 2. *Physioceæ* Rost.
- " 3. *Didymiaceæ* Rost.
- " 4. *Spumariaceæ* Rost.

ORDER AMAUROCHETÆ Rost.

Family 1. *Echinosteliaceæ* Rost.

- " 2. *Stemonitaceæ* Bel.
- " 3. *Kaciborskiaceæ* Bel.

- " 4. *Amaurochaetaceæ* Rost.
- " 5. *Brefeldiaceæ* Rost.
- " 6. *Enerthenemaceæ* Rost.

ORDER ANEMEE Rost.

Family 1. *Liceaceæ* Rost.

- " 2. *Clathroptychiaceæ* Rost.

ORDER HETERODERMEÆ Rost.

Family 1. *Cribrariaceæ* Rost.

ORDER COLUMELLIFERÆ Rost.

Family 1. *Riticalariaceæ* Rost.

ORDER CALONEMEÆ Rost.

Family 1. *Perichaenaceæ* Rost.

- " 2. *Arprieaceæ* Rost.
- " 3. *Trichiaceæ* Rost.

Appendix. ORDER SOROPHOREÆ Zoph.

Family 1. *Guttubineæ* Zoph.

- " 2. *Dictyosteliaceæ* Rost.

Sub Cohort II. **Monadineæ** Cienk.

ORDER MONADINEÆ AZOOSPOREÆ Zopf.

Family 1. *Vampyrelleæ* Zopf.

- " 2. *Burrsullineæ* Zopf.
- " 3. *Monocystaceæ* Zopf.

ORDER MONODINEÆ ZOOSPOREÆ Zopf.

Family 1. *Pseudosporeæ* Zopf.

- " 2. *Gymnococcaceæ* Zopf.
- " 3. *Plasmodiodiophorde* Zopf.

ORDER USTILAGINEÆ Tul.

Artificially divided into "Amerosporeæ" "Didymosporeæ" and "Dictyosporeæ."

ORDER UREDINEÆ Brongn.

Artificially divided into "Amerosporeæ" "Didymosporeæ" and "Dictyosporeæ."

The final volume will contain the Discomycetæ, Tuberacæ and Satrigomycetæ, and the whole work will then be one which every student of the Fungi will need to have. The descriptions, while often mere translations or copies of the originals, are in the case of the species of certain groups entirely re-written. The total cost of the whole work will be about one hundred dollars.—Charles E. Bessey.

ZOOLOGY,

TWO REMARKABLE RADIATES.—In the *Aarsberetning* of the Bergen Museum for 1887 (but recently issued), Dr. D. C. Danielsen describes two interesting forms obtained by the dredge in the recent Norse North Atlantic Expedition. When collected they were

regarded as sea anemones allied to *Halcampa* and *Cerianthus*, but anatomical investigation shows them to differ from all Cœlenterates in just that feature which has been regarded as diagnostic of the group, while on the other hand they have many points in common with the actinians. For them Dr. Danielssen has made the Tribe Aegireæ which he defines as "Actinida, with a perfect body cavity (Cœlom) and a developed digestive apparatus consisting of œsophagus, stomach and anus." The two genus are called Fenja and Aegir, names derived from Scandinavian mythology. In general terms they may be described as sea anemones whose so-called stomach (Actinostom of Agassiz) has extended down to the base thus partially (Aegir) or completely (Fenja) separating the digestive from the mesenterical spaces, while in both an anus is developed in the base. In both the cœlome thus formed is divided by twelve perfect septa, but in Aegir these spaces communicate by twelve slender fissures with the rectal area of the digestive tract. In Fenja there are twelve genital pores around the anus, outside the rectum; in Aegir the genitalia are more like those of ordinary sea anemones. Both forms are hermaphrodites.

As will be seen these forms which in every other respect are true sea anemones differ from all cœlenterates in the distinction between digestive and cœlomic cavities. On the other hand they differ from the true Cœlomata in the fact that each cœlomatic space extends the length of the body. While interesting, in a general way, as indicating a possible development of the cœloma of higher animals from the mesenterical space of an actinian, we cannot regard them as being links in the line connecting the Cœlenterata with segmented animals, according to the theories of Balfour and Sedgwick, for that demands the conversion of the cœlenterate mouth into mouth and anus, while the anus of Aegireæ is clearly not derived in this way, but is rather a perforation through the base of attachment of the ordinary sea anemone. Occasionally such "anal pores" occur in the Cerianthidæ. An extensive account illustrated by over twenty plates is promised at an early date.

THE EYES OF TRILOBITES.—Mr. J. M. Clarke gives an account of the eyes of the trilobite *Phacops rana* in the *Journal of Morphology*, Vol. II., 1888. He divides the trilobites into two groups, Holochroal and Schizochroal, according as the external surface of the cornea is faceted or not. The Phacopidæ belong to the latter group, and their eyes are to be regarded as aggregate rather than compound. The corneal lenses were hollow or filled with some substance different from the cornea. Nothing like a crystalline cone has been preserved. Until maturity the number of eyes in an optical organ increases by the addition of new lenses at the ends of the diagonal rows, and these new lenses are apparently formed by a thinning of the integument. (The reporter would remark that there seems to be a difference in the way in which, according to Mr

Clarke's observations, the visual area is increased in the trilobites and that shown by Mr. Watase's unpublished observations on the eyes of *Limulus*.) After maturity, although the trilobite may continue to increase in size, senility begins and with it there is a decrease in the number of optical elements.

In a concluding note Mr. Clarke calls attention to the fact that in the Leptostracan genus *Mesothyra* of the Portage (Devonian) group "the eye consists of a single deep pit at the summit of the optic node."

THE SEXES OF MYXINE.—Dr. Fridtjof Nansen (Bergens Museum's *Aarsberetning*, 1887) states that in his studies of the nervous system of Myxine he was struck by the fact that it seemed as if females only came under review. He therefore investigated the subject, and after reviewing the more prominent papers and detailing his own investigations states his conclusions that "Myxine is generally or always (?), in its young state, a male; whilst at a more advanced stage it becomes transformed into a female." The genital organs are female in front and male behind. Nansen has investigated the spermatogenesis but his results are widely at variance with those of Cunningham. He has also tried, but in vain, to obtain the embryology of this form. Myxine is extremely abundant at Bergen, but dredging in the harbor at all seasons of the year has failed to produce a single ovum. He has tried to breed them in confinement but though gravid females were kept in wooden cages for half a year they obstinately refused to lay their eggs. From his studies of ovaries he concluded that eggs were deposited at all seasons of the year, and he adds to our knowledge of specimens of the eggs of Myxine by recording one dredged in 1857 by Dr. Danielssen and his son near Molde. Nansen does not seem to be familiar with a paper by Putman on Myxine and *Bdellostoma* in the *Proceedings* of the Boston Society of Natural History some years ago.

ZOOLOGICAL NEWS.—PROTOZOA.—Mr. Beddard, in his earthworm studies, has recently met (*Proc. Zool. Soc.*, London, 1888, p. 355) a gregarine in the body cavity of a New Zealand Perichaeta which is remarkable among gregarines in forming a nucleated cyst.

Dr. L. Plate (*Zool. Jahrbuch*, III., 1888) describes under the name *Acinetoides* a new infusorian, of which two species were found at Naples, which seems to connect the *Acinetæ* and *Ciliata*. It bears a clubbed suctorial thread for taking food, which is shorter and stiffer than those in the true *Acinete*; and it possesses besides longitudinal rows of cilia on the ventral surface. *Acinetoides* forms colonies and has been seen to divide transversely.

CÆLENTERATA.—Gireg describes and figures as new (Bergens Museum's *Aarsberetning* for 1887) *Rhizoxenia alba* and *Sympodium margaritaceum* from the Norwegian coast.

EMBRYOLOGY.¹

THE STRUCTURE OF THE HUMAN SPERMATOZOON.—Any new light which is thrown upon the structure of the sexual elements by the aid of more refined methods of research, will be welcomed in view of the possible bearings which such information may have upon questions of inheritance. That variations in the structure of the male elements do occur as abnormalities seems to be established by the researches of E. M. Nelson², who finds that not only do they vary in the number of heads, but also in the number of tails and even as to the number of the nuclei; forms were also met with which were joined together in pairs by a band. Those familiar with Selenka's work on the Opossum will recall in this connection the singular fact recorded by that embryologist as to the double nature of the fresh spermatozoa of *Didelphys virginiana*.

The most interesting facts, however, which Mr. Nelson records as the result of his studies, with the aid of the new apochromatic objectives of Zeiss, relate to the details of structure of the human male element.

The head, which has always been figured as a simple, somewhat flattened pyriform body, according to this last observer, is rather complex when studied by the aid of better appliances. It is rather obovate in outline from the broad side, but when viewed edgewise it is seen to be curved upon itself, so that it bears a resemblance to an oblong meniscus lens.

Furthermore, this observer gives names to its parts. The anterior portion containing the nucleus, he calls the *spore*, and at its extreme anterior pole it bears an excessively minute *filament* as he names it, which is hardly as long as the spore itself. He suggests that this is a sort of feeler or tentacle by means of which the spermatozoon finds its way into the pore in the ovum which serves for the micropyle.

The flattened and curved flagellum-bearing spore is joined to or rests in what Nelson calls the *cup* which corresponds to the swollen basal part of the head as usually figured.

Then succeeds a delicate cycle of processes just around the base of the cup where the latter joins what Nelson calls the *stem*, which answers to the "middle piece" of authors. This delicate cycle of bluntly rounded processes he calls the *calyx*.

Next follows the *stem* or "middle piece" which at its posterior extremity is slightly swollen. This swollen posterior extremity of the stem and the anterior end of the tail there occurs a constriction which has been previously noticed by Nelson, and to which he gives

¹ Edited by Prof. John A. Ryder, University of Pennsylvania, Philadelphia.

² On the human spermatozoon, Journ. Quekett Microscop. Club. Ser. II, Vol. III, No. 23. Jan., 1889. pp. 310-314.

the appropriate name of *joint*. It seems, in fact, as if such were its nature, as a very short refringent and dark band of substance here joins the stem and tail together. This band is so much narrower than the stem or tail that it appears as if there were a deep notch on either side of the tail portion of the spermatozoon at this point.

Immediately behind the joint, the flagelliform tail is continued as that tapering organ¹ familiar to all histologists since the time of Leeuwenhoek.

The structure of the spermatozoon is therefore more complex than is usually supposed, and the following eight parts may be distinguished, beginning at the anterior extremity :

Filament, spore, cup, calyx, stem, joint, tail.

The following measurements are given :

Head (spore and cup) long	$\frac{42}{100}$	in.	5.9 μ
" " broad	$\frac{17}{100}$	"	3.4 μ
Stem long	$\frac{57}{100}$	"	4.4 μ
Tail from joint to tip	$\frac{1}{100}$	"	.05 mm.
Total, head, stem and tail	$\frac{100}{100}$	"	.06 mm.

From what has preceded it is clear that there is great capacity for variation. Further, it is probable that this high degree of complexity signifies that a very considerable part of the spermatozoon is of secondary importance, or is rather only accessory to the act of fertilization or the formation of an *öosperm*. The already remarkable results of those investigators who have occupied themselves with the study of the phenomena of fertilization, must undoubtedly be modified when the subject is viewed from the basis of a renewed study of the structure and function of the spermatozoon at all phases of the process of its union with the ovum. May it not be that some important parts of the process of union have escaped observation in virtue of the optical difficulties which are involved? The consequences of fertilization as the result of union with abnormal spermatozoa is also worthy of consideration, not only from a purely scientific standpoint, but also on account of the possible light it might throw upon possible abnormalities so provoked, which eventuate in disease and deformity. Truly, to those who are familiar with the great number of forms assumed by the male element throughout the animal kingdom, and the very diverse conditions under which fertilization occurs, it seems as if Du Bois Reymond's reproach—*Ignorabimus*—may here remain true.

¹ It may possibly be of advantage to use the word *organula* here instead of organ, following a suggestion of Möbius. Functionally differentiated multicellular aggregates in multicellular forms or metazoa are in this sense organs, while for functionally differentiated portions of unicellular organisms or for such differentiated portions of the unicellular germ-elements of metazoa the diminutive—*organula*—is appropriate.

ARCHÆOLOGY AND ANTHROPOLOGY.¹

MOUND AND OTHER EXPLORATIONS BY MR. WARREN K. MOORE-HEAD.—On the high wooded hills bordering the Little Miami River in central Greene County are a number of mounds. One is the large mound on the farm of Mr. J. B. Lucas, three miles west of Xenia. Up to June, 1885, this mound had never been thoroughly explored. It was about twenty feet in height with a slightly flattened summit, perhaps seven feet across, and sixty feet in diameter at the base. Four good sized trees grew out of the sides, one of which was an oak perhaps ninety years old.

This mound was opened in June, 1885. A shaft was sunk, from the summit downwards, twelve feet, but nothing of interest found. We began a trench on the outer edge of the east side, and carried it to the center; then extended the trench from the summit down until these two met. Completing this work, we caved in the sides, and threw back the earth taken out, thus restoring the mound nearly to its former shape.

The trench from the outer edge of the mound to the center was about twenty-five feet in length. For the first ten feet of this distance the earth was fine clay, not mixed with ashes. At twelve feet from the outer circumference was a bed of ashes and charcoal, perhaps two feet in thickness, and sticks of the half-charred wood three feet long and quite well preserved were taken out. These had been laid with regularity and were probably covered with earth before the fire had consumed them. At sixteen feet a thin irregular stratum of ordinary river sand was found, three or four inches in thickness.

Immediately following this sand layer, and extending upwards possibly three feet, was a mass of hard, burned clay. When this was reached we stopped work in the trench and went to the shaft above. We had not thrown out a foot of earth until we came to a mass of charcoal and ashes. This occurred without intermission for two feet or more when we came upon a layer of pure clay, nearly two feet in thickness. Immediately below this was the thin stratum of sand, and under this sand, resting on the "altar" of burnt clay, were five skeletons much decomposed. Of these, the teeth and small fragments of the skull and short sections of the femur and tibia were all that could be preserved. The skeletons were buried side by side; the heads to the south. At the feet were fragments of a clay urn, peculiarly shaped. It had been broken into seven or eight pieces, but could be easily restored. It was of the "basket-moulded" pattern, having plain marks of the basket reeds

¹ This department is edited by Thomas Wilson, Esq., Smithsonian Institution, Washington, D. C.

on the surface—a pattern rare in Ohio. Save a few perforated bear teeth and three rough spear-heads, no other relics were found. The excavation from both summit and base were carried through the burnt clay to the original level below. The clay contained fragments of calcined bones evidently of animals such as the deer, bear, and raccoon.

The opposite side of the mound (the west side) has since been opened by parties living near, but nothing found.

TWO INDIAN CEMETERIES NEAR ROMNEY, HAMPSHIRE COUNTY, W. VA.—Eight miles up the south fork of the Potomac River from Romney, W. Va., is an island owned by Mr. I. Pancake, and on this island once stood a large Indian village. A flood some two years ago cut a channel through the island and exposed to view the skeletons of many human beings, as well as relics and objects of aboriginal manufacture. Recent newspaper reports attracted Mr. Moorehead's attention, and he visited the spot for the purpose of investigation.

With a force of several Irishmen, work was commenced the morning of January 16 '89. A large part of the island was carefully dug over and the earth examined to a depth of four feet. It was found that over one-half of the bodies originally interred had been washed out by the flood; those that remained were scarcely two feet below the surface, consequently when the island was cultivated the bones would be much disturbed. Only five skeletons could be taken out entire, those at a depth of three feet. With two of them were buried several triangular arrow-heads, a clay pot, whole, (not decorated) and fragmentary bones of deer, ground hog, and turtle. With the others nothing was found. On the surface of this island we picked up many beads, arrow-heads, broken pottery, split bones, carved bones, unfinished celts, etc. The space occupied by the evidences of Indian occupation was about 150x200 yards. The most interesting find met with during the excavation of these graves was the discovery of a large ash pit, about six by seven feet, five feet in depth. In this there were many deer bones, broken pottery, ashes, charcoal, etc. There was no order observed, the accumulation seemed to result from a hearth or wigwam. The only object found in the pit was a long sharp bone awl, a fine specimen. A part of a skeleton (said by some to be Ox, by others Bison) was taken from the bottom of this pit. The bones showed action of fire, and many of them were broken into fragments.

Two days were spent in examining another village site, on the north side of the river twelve miles below. This was smaller than the one above mentioned, but as it had been little disturbed we found more skeletons, etc. This site does not exceed 200x450 feet. In a space of 60x100 feet we took out fifteen skeletons in a fairly good state of preservation. All were buried singly and extended, save

four. These four were heaped together; the skull of one was missing, the arms of another gone, and the leg of a third absent.

Four others had nothing whatever placed in their graves. Two of the remaining seven had broken pottery and a few arrow-heads with them. The others were buried nearly with their heads to the South. With the first were 62 bone beads and from their curved position plainly showed they had originally been on a string. The second had a neat little urn with handles, and containing a carved mussel shell, placed by his head. This pot was seven inches high, four inches in diameter, and was decorated with spiral lines. The third personage had nearly 300 glass beads between the ulna and radius. A small iron tomahawk near his hand showed furthermore that he had known the "long-knives."

The fourth Indian had a copper plate (Lake Superior copper) over his head, four and a half inches long, two inches wide; perforated near one end. Beneath his head were twenty-four broken quartz fragments about the size of an egg.

The fifth individual has a small copper earring, a tip to an arrow made of copper, and three large glass beads. The skulls of three of these five were taken out nearly whole. The average depth of the interment of these bodies did not exceed two and a half feet.

The owner of the land presented the writer with a copper plate and a stone tomahawk (greenstone) from the same spot. He claimed that after a heavy rain twelve circular spots about ten feet in diameter could be plainly seen in the field, that these spots had a reddish color, and were arranged in two rows. He further said that he thought them burnt spots of ground where the wigwams stood. That the field had been cultivated only a few years which accounted for the spot being still discernable. The bodies found by myself were *all under these spots. No skeletons* were exhumed in ground *not included* in these reddish circular places.

After the work here was completed, a mound on one of the high hills overlooking the valley was examined. Its dimensions were 35 x 45 feet diameter and six feet high. It was one mile north of Romney. The material was half stone, half earth. Seven men were all day in digging it through; the whole structure was removed. Nothing was found save one decayed skeleton. This skeleton had five large mica plates placed where his breast had once been, a copper bead has served as an earring, a slate ornament as a breast-plate, and five black serrated arrow-heads as weapons. The mica was 7x10 inches in size. The ornament 5x2, with two perforations.

SCIENTIFIC NEWS.

—The Geological Society was organized at Ithaca, New York, on December 29, 1888. The original fellows number one hundred and nine. The admission fee is \$10.

—The trustees of the Australian Museum, Sydney, have recently decided to continue the publication of the rich collection of drawings and MSS. left by the late Alexander Scott, and since acquired by them, and the work of revising and editing this material has been entrusted to his daughter, Mrs. E. Forde, and Mr. A. Sidney Olliff.

—The Marine Biological Laboratory has just issued its circulars for the coming summer's session. Dr. C. O. Whitman will be the director. He will be assisted in the Investigator's Department by Drs. Howard Ayers and E. G. Gardiner, and in the Student's Department by Drs. J. S. Kingsley and J. P. McMurrich and Prof. J. Ellis Humphrey.

The laboratory is located at Wood's Holl, Mass., near the laboratories of the United States Fish Commission. The building consists of two stories: the lower, for the use of students receiving instruction, the upper, exclusively for investigators. The laboratory has aquaria supplied with running sea-water, boats, collecting apparatus, and dredges; it will also be supplied with reagents, glassware, and a limited number of microtomes and microscopes. The library will be provided, not only with the ordinary text-books and works of reference, but also with the more important journals of zoology and botany, many of them in complete series. The Laboratory for Investigators will be open from June 3 to August 31. It will be fully equipped with aquaria, glassware, reagents, etc., but microscopes and microtomes will not be provided. In this department there are eight private rooms for the use of investigators not requiring instruction, who are invited to carry on their researches at the laboratory. Those who require supervision in their work, or, being already prepared to begin original work, desire special suggestions and criticism, or extended instruction in technique, will occupy tables in the general laboratory for investigators, and will pay for its privileges a fee of fifty dollars. The Laboratory for Students will be opened on Wednesday, July 10, for regular courses of seven weeks in Marine Zoology and Microscopical Technique. Botany will be taught for the present season during August. Opportunities will be given for collecting and preparing material for use in the class-room and for special lines of study. The fee for workers in this department is twenty-five dollars, payable in advance. The number of students will be limited to twenty-five, and preference will be given to teachers or others already qualified. By permission of the Director, students may begin their individual work as early as June 15, without extra charge, but the regular courses of instruction will not begin before July 10.

Applications should be addressed to Miss A. D. Phillips, *Secretary*, 23 Marlboro St., Boston, Mass.

—An important series of lectures on Evolution is being delivered in the Second Unitarian Church of Brooklyn (Dr. Chadwick's), under the auspices of the Brooklyn Ethical Association. The lectures are delivered on alternate Sunday evenings, beginning on Oct. 14 and ending May 26. They are issued in pamphlet form and may be obtained from Dr. Lewis G. James, President, No. 55 Liberty St., New York.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

BIOLOGICAL SOCIETY OF WASHINGTON.—Annual meeting, and election of officers for 1889, *January 12, 1889*.—The following officers were elected :

President—Lester F. Ward.

Vice-Presidents—C. V. Riley, R. Rathbun, C. H. Merriam, Frank Baker.

Recording Secretary—J. B. Smith.

Corresponding Secretary—F. A. Lucas.

Treasurer—F. H. Knowlton.

Members of Council—Geo. Vasey, J. H. Bean, R. E. C. Stearns, C. D. Walcott, F. W. True.

January 26.—The following communications were read : Dr. Cooper Curtice, Notes on the Sheep Tick, *Melophagus ovinus* Linn.; Dr. Geo. Vasey, New Species of North American *Gramineæ* of the Last Twelve Years ; Mr. Th. Holm, Contributions to the Morphology of the Genus *Carex* ; Dr. C. Hart Merriam, A New Species of Pika (*Lagomys*).

NATURAL SCIENCE ASSOCIATION OF STATEN ISLAND.—*January 12, 1889*.—Mr. Wm. T. Davis read the following notes in regard to the appearance of shad along our shores :

"It has been the custom among those engaged in shad fishing in the bay to preserve a record of their first catch, which sometimes merely consists in chalking the date on the beams in the houses where they keep their nets and live, so as to lose no time at the turning of the tide. In one of these houses I copied the following dates, posted on the rafters overhead, as already described :

"April 3, 1873; March 30, 1874; March 28, 1878; March 30, 1879; April 4, 1880; April 5, 1881; April 4, 1883; April 9, 1884, 49 fish taken; April 11, 1885, 1 fish taken; April 11, 1886; April 9, 1887, 36 fish taken; April 11, 1888, 29 fish taken.

"Mr. Wm. H. Wardell, who lives at Bay Ridge, Long Island, but who fishes from the Staten Island shore, has given me the following record of his first captures :

"April 3, 1878; March 29, 1879; March 28, 1880; April 9, 1881; April 5, 1882; April 5, 1883; April 1, 1884; April 3, 1885; April 5, 1886; April 7, 1887; April 11, 1888.

"One of the signs of the Indians' calendar was the blossoming of the 'shad bush' (*Amelanchier*), which occurs about the middle of April,

and it will be seen from the above dates to be an excellent guide, for it is not until its flowers appear that the fish come in numbers."

Mr. Chas. W. Leng presented the following memorandum: "In the Proceedings of April 14, 1888, a correction must be made in regard to the pupation of water beetles, the fact being that they pupate not under water, but in soil. Mr. Davis has this year raised the larvæ of *Hydrophilus triangularis* and supplied a part of the larvæ with soil under water and others simply with soil. The first lot refused to pupate, while many of the second lot formed pupæ in the ground."

THE INDIANA ACADEMY OF SCIENCE held its annual meeting in the Court-House at Indianapolis Dec. 25, 26, and 27. The following papers were read: Geographical Distribution of Umbellifers, J. M. Coulter; A Study of the Sub-epidermal Rusts of Grasses and Sedges, H. L. Bolley; The Future of Systematic Botany, J. M. Coulter; Raphides in Fruit of *Monstera deliciosa*, W. S. Windle; The Spines of Cactaceæ, Walter H. Evans; Strengthening Cells and Resin Ducts in *Coniferae* (by abstract), S. Coulter; The Epidermal Scales of *Tillandsia*, H. Seaton; Peculiarities of the Indiana Flora, J. M. Coulter; An Objection to the Contraction Hypothesis as Accounting for Mountains, F. B. Taylor; The Old Channel of Niagara River, J. T. Scovell; The "Collett Glacial River," J. L. Campbell; A Sketch of the Geology of Arkansas, J. C. Branner; Evidences of Shallow Water Deposition of Silurian Rocks, Chas. W. Hargitt; Meanderings of the Arkansas River Below Little Rock, J. C. Branner; Occurrence of *Ancistrodon contortrix* in Dearborn County, Ind., C. W. Hargitt; Some Strange Cases of Color Variation in Animals, C. W. Hargitt; *Amœba*: a Query, S. Coulter; On a Striped Spermatophile Mammal New to Indiana, A. W. Butler; Explorations of the United States Fish Commission in Virginia and North Carolina, D. S. Jordan; Analogy between River Faunæ and Island Faunæ, D. S. Jordan; Outline of Work in Physiological Psychology, W. J. Bryan; The Ancestry of the Blind Fishes, D. S. Jordan; A New Kind of Phosphorescent Organs in *Porichthys*, Fred. C. Test; Notes on Indiana Reptiles, A. W. Butler; On the Skull of the Larva of *Amphiuma means*, On the Hyobranchial Apparatus of *Amblystoma microstomum*, Further on the Habits of Some *Amblystomas*, O. P. Hay; Contributions to the Knowledge of the Genus *Branchipus*, O. P. and W. P. Hay; The Occurrence in Indiana of the Wood Ibis (*Tantalus loculator*), B. W. Evermann; The Relation of Systematic Zoology to Museum Administration, D. S. Jordan; Observations on the Destruction of Birds by Storms on Lake Michigan, A. W. Butler; Additions to the Fish-Fauna of Vigo County, Indiana, B. W. Evermann; Some Notes on the Natural History of Guaymas, Mexico, O. P. Jenkins and B. W. Evermann. The Presidential address, "Religion and Continuity," was delivered Christmas night by Dr. D. P. D. John. The following officers were elected for the following year: President, John C. Branner; Vice-Presidents, T. C. Mendenhall, Oliver P. Hay, John L. Campbell; Secretary, Amos W. Butler; Treasurer, Oliver P. Jenkins. The Field-meeting will be held at Greensburg, Ind., in May.

